THE MIDLAND NATURALIST:

THE JOURNAL OF THE
ASSOCIATED NATURAL HISTORY, PHILOSOPHICAL,
AND ARCHÆOLOGICAL SOCIETIES AND FIELD CLUBS
OF THE MIDLAND COUNTIES.

EDITED BY
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"Come forth into the light of things,
Let Nature be your teacher."

Wordsworth.

VOLUME I.

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WORTHINGTON SMITH DEL ET

PREFACE.

The completion of the first volume of the "Midland Naturalist" seems to call for a few remarks from those who undertook its editorship.

The purposes and aims of this periodical are fully set forth in the opening address (p. 1.) How far the ideas and hopes therein expressed have been fulfilled we must leave our readers to decide, but we can earnestly assure them that on the part of the Editors and Publishers no efforts have been spared to realise all that was promised.

It is, however, with the future rather than with the past that we are now concerned. If the "Midland Naturalist" is to assume its proper position in scientific literature, as the official organ of so large and influential a body as the *Midland Union of Scientific and Literary Societies,* then continual efforts must be made for its improvement. But the power to so improve our Magazine, to illustrate it well, as we wish to do, to enlarge it so as to admit both popular and abstruse scientific communications, is entirely dependent on the number of subscribers. Of the 4,000 members belonging to our Union, too few have, as yet, become annual subscribers to this Journal. During the coming year their number ought to be largely increased, and we ask every one of our readers to aid in bringing this about.

Furthermore, every subscriber should consider him or herself as commissioned to observe and report on all occurrences of scientific interest which may happen in their neighbourhood. It cannot be doubted that hundreds of

facts, which if published would be of scientific value, are yearly observed by some one or other, but lost because not recorded. If our readers will help us in this respect, our endeavour to make the "Midland Naturalist" a magazine of Midland Counties Natural History will be realised.

Many of our readers have given us valuable assistance, and to all the kind friends who have contributed to our pages we tender our warmest thanks. We owe especial thanks to Mr. W. R. Hughes, F.L.S., and Mr. W. B. Grove, B.A., not only for contributions, but for unceasing help in correcting proofs, and in other ways.

We also gratefully acknowledge the services rendered by our eighty Meteorological observers, who have enabled us to publish from month to month a very complete record of the weather of the Midlands.

To Mr. Charles E. Scarse, of the Birmingham Library, both we and our readers are greatly indebted, for compiling the excellent Index we are enabled to publish of the contents of our first volume.

During the coming year we hope to present our readers with a number of interesting papers. To the January part Philip Henry Gosse, Esq., F.R.S., will contribute a most valuable account of a Marine Aquarium on the circulating principle recently erected by him in his house at Torquay. We shall also soon commence a series of practical Geological papers, entitled "Rambles with a Hammer in the Midland Counties." The important communications with which Dr. T. Spencer Cobbold, F.R.S., has favoured us will be continued, as will also Mr. James E. Bagnall's "Moss Habitats;" the latter gentleman is also preparing some articles on "The Cryptogamic Flora of Warwickshire." Mr. W. B. Grove, B.A., will contribute some papers on "The Pronunciation of Scientific Names." The Glacial scheme (see p. 242) will, we trust, be productive of good results, which we shall be glad to chronicle. A paper on "Practical Meteorology," with illustrations of the most recent improvements in meteorological apparatus, is also in hand. Entomology, Ornithology, and Microscopy will not be forgotten; but for these subjects we invite and shall be glad to receive further aid.

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THE MIDLAND NATURALIST.

"Come forth into the light of things,
Let Nature be your teacher."
Wordsworth.

OPENING ADDRESS.

The first idea of a Midland Union of Natural History Societies dates back about four years. Early in 1874 the Tamworth Natural History, Geological, and Antiquarian Society held a very successful *soiree*, in which the Birmingham Natural History and Microscopical Society took part. That meeting was in every way so satisfactory, and gave such proofs of the value of co-operation, that many who attended it expressed a desire for more instances of a like kind. Mr. W. G. Blatch, the then Honorary Secretary of the Birmingham Society, suggested that an Annual Congress should be held, and proposed the combination, in some way, of our Local Natural History Societies. Although the suggestion was favourably received and formed the subject of frequent conversations, and although it was generally admitted that an association of the kind could scarcely fail to be attended with valuable results, no practical step was immediately taken.

It was not till the 17th August, 1876, that anything definite was done. A proposal was then made, at a meeting of the Committee of the Birmingham Society, which resulted in the appointment of a sub-committee, (consisting of Messrs. Lawson Tait, John Morley, and James Bagnall,). which was requested to obtain information as to the possibility of forming a Union of the Natural History Societies of the Midland District. In the following October Mr. Blatch read a paper at a *soiree* of the Birmingham Society on "Suggestions for a Congress of Natural History Societies." The Sub-committee, having reported on what had been ascertained, were further directed to proceed with the formation of the Union. In this matter considerable delay was caused by difficulties in obtaining information and in eliciting replies. Delegates having been appointed by the various societies who were willing to join the Union, the Sub-committee summoned them together, and they met at the Midland Institute, Birmingham, on August 28th, 1877. At this meeting the basis of the Union was laid down, and a Council elected.

The first meeting of the Council, composed of two representatives from each society, was held on the 16th October last, Mr. Edmund Tonks, B.C.L., presiding, and Mr. Lawson Tait acting as secretary. These gentlemen represented the Birmingham Natural History and Microscopical Society. There were also present the Rev. O. M. Feilden, M.A., (Hon. Sec. of the Oswestry and Welshpool Naturalists' Field Club,) Mr. C. T. Musson, (Hon. Sec. of the Nottingham Naturalists' Society,) Mr. Egbert D. Hamel, (of the Tamworth Natural History, Geological, and Antiquarian Society,) Mr. Thos. Carter, LL.B., (Hon. Sec.,) and Mr. F. T. Mott, (of the Natural History Section of the Leicester Literary and Philosophical Society,) the Rev. W. Elliot, M.A., (Hon. Sec. of the Caradoc Field Club,) and Mr. C. U. Tripp, M.A., (Hon. Sec.,) and Rev. C. F. Thornewill, M.A., (of the Burton-on-Trent Natural History and Archæological Society.) The following resolutions were passed :—1.—That the annual meetings of the Union be held in May. 2.—That the first annual meeting be held in connection with the Birmingham Natural History and Microscopical Society. 3.—That each society in the Union shall, for the purpose of meeting necessary expenditure, contribute annually the sum of one penny per member, but societies whose members are less than 24 in number shall each contribute two shillings for the whole of such society. 4.—That a monthly magazine, to be called the MIDLAND NATURALIST, be issued by the Union, and that Mr. E. W. Badger, of Birmingham, and Mr. W. J. Harrison, F.G.S., of Leicester, be appointed Editors. 5.—That the Editors of the Magazine be Hon. Secretaries of the Union. 6.—That Messrs. Thornewill and Tait be a Subcommittee to prepare bye-laws and report thereon. 7.—That Mr. Egbert D. Hamel be Treasurer of the Union. 8.—That the Secretary of each Society in the Union be requested to ascertain, and communicate to the Editors, the number of members who will subscribe to the Magazine. 9.—That Mr. Lawson Tait be authorised to issue a prospectus of the MIDLAND NATURALIST, and provide the Secretaries with a sufficient number for distribution among the members. 10.—That the best thanks of the Council be given to Mr. Lawson Tait for his successful efforts, which have led to the formation of the Union.

The objects of the Union may be broadly stated to be to extend the usefulness of local societies by affording facilities for inter-communication through an authorised and regularly published magazine, which shall record the more important work done by them; announce their forthcoming meetings; and assist in the interchange of notes and specimens; and, by providing opportunities for personal intercourse among the members at meetings to be held from time to time in various places of interest, and in other ways, to promote the study of natural history, especially that of the midland district.

The affairs of the Union will be managed by the Council, which consists of two members from each of the Societies, one of whom must be a Secretary; and the Secretaries of the Societies in the Union will form a Standing Committee to arrange for Joint Excursions, timely notice of which will be given in our pages.

The work proposed has been set about in a quiet, unostentatious manner, but we feel sure the results cannot fail to be important, if only the many earnest students resident in the central counties of England, will each do his own share of it.

The Societies already in the Union are the following :—

- Birmingham Natural History and Microscopical Society.
- Birmingham Philosophical Society.
- Birmingham School Natural History Society.
- Burton-on-Trent Natural History and Archæological Society.
- Caradoc Field Club.
- Derbyshire Naturalists' Society.
- Dudley and Midland Geological and Philosophical Society and Field Club.
- Leicester Literary and Philosophical Society.
- Northampton Naturalists' Society.
- Nottingham Literary and Philosophical Society.
- Nottingham Naturalists' Society.
- Rugby School Natural History Society.
- Oswestry and Welshpool Naturalists' Field Club.
- Severn Valley Naturalists' Field Club.
- Shropshire Archæological and Natural History Society.
- Stroud Natural History and Philosophical Society.
- Tamworth Natural History, Geological, and Antiquarian Society.

One of the means which the Union intends to employ in effecting its objects is the monthly publication of the MIDLAND NATURALIST.

The present issue will afford a general notion of the character of future numbers, though we may fairly hope that many improvements will be made as experience is gained, and the circle of our contributors widens. We shall hope to be able to secure for each month well written original articles; short items of science news; meteorological and other observations; brief reports of the recent work done by each Society; a diary of coming meetings and excursions; queries and answers to them; correspondence, and other matters.

But we cannot hope to do this single-handed. We wish to interest all our subscribers, and to do this we shall want a large amount of help. We, therefore, solicit the communication

of short original articles of general interest, from students of every branch of Natural History, Microscopy, &c. We shall be glad to receive brief notes of original observations on any subject suitable for our pages, and shall be grateful for judicious hints and suggestions.

At present, whenever a good paper is read before one of our local societies its usefulness is too often limited to the members of that society, and generally to that part of them who chance to hear it read. By printing such papers, or abstracts of them, in this magazine, their usefulness will be widely extended, and all the Societies may benefit by them; while to the younger members, and the less informed generally, they may prove of incalculable advantage by aiding them in studies already entered upon, or pointing out suitable ones to engage in.

We should like our readers to bear in mind that this magazine is not intended to supersede or in any way to interfere with the publication of Transactions by individual Societies. We shall on the contrary aid in making them known.

Occasionally reviews of new scientific books will occupy a part of our space, and we hope to have it in our power to aid such of our Societies as recognise local antiquities and archæology as part of their work.

The publication of a diary of coming meetings and excursions ought to prove most useful, and if members generally will send their names as subscribers for the magazine they will justify their Societies in ceasing to issue their monthly programmes, the cost and postage of which at present forms a considerable item in the sum of incidental expenditure, especially in the larger Societies.

If this magazine is to be a permanent publication we must secure a good circulation. We therefore ask the cordial co-operation of our subscribers by assisting us among their friends. In helping us they will be helping themselves. If every reader of this first number who approves of our labours and object will be good enough to obtain for us at least another subscriber he will materially aid us in our endeavours, and increase our power of making the magazine a useful medium for intercourse between naturalists of all classes in the Midland Counties.

METEOROLOGY.—In future numbers it will be our aim to present as complete a record as possible of, at all events, the Temperature and Rainfall in the Midland Counties. All observers who can aid in this matter are requested to communicate with Mr. W. J. Harrison, Town Museum, Leicester, who will forward forms on which to record observations.

ABNORMAL FERNS.*

BY E. J. LOWE, ESQ., F.R.S., &C.

The reproduction of ferns from spores is a study of much interest, and one worthy of more general attention. The *modus operandi* is fraught with difficulties. The minute size of the infant ferns in their first growth is in itself dangerous, as any neglect will at once destroy the whole crop. The spores germinate as mere green points, imperceptible at first to the unassisted eye, and only rendered visible by the look of greenness from a number springing into life together. Spores of ferns differ from seeds of plants, inasmuch as they have no special organs; consisting merely of a homogeneous cellular mass. In seeds the young roots and the young shoots are present in the embryo, being developed from determinate points; whilst spores, on the contrary, consist merely of single vegetable cells, growing indifferently from any part of the surface.

These points of life, (*germinal fronds*,) as they continue to grow have a strong resemblance to Liverwort, (hence the term Marchantia-like.) They gradually increase in size, and, if they do not become impregnated, will occasionally exceed half an inch in diameter.

The impregnation of the germinal frond does not seem to be capable of being accomplished without the action of strong light; indeed, grown in a somewhat dark corner the growth seems to be arrested before arriving at that particular stage of life. The following experiment will illustrate what is meant:—Three years ago a large Wardian case was prepared, and the surface of the soil scattered over with spores from a number of varieties of *Scolopendrium vulgare*, *Lastrea filix-mas*, *Athyrium filix-fœmina*, *Polystichum angulare*, and of *Lastrea dilatata;* each species being in a separate partition. This case was placed in a somewhat dark corner, under a plant stage. When the spores had been sown about six months the whole surface soil was covered over (and had been for several weeks previously) with the vivid green of the young ferns. At this time a second case was prepared, not for spore sowing, but for transplanting, in patches, the germinal fronds from the first case. Small portions of this green mass were lifted on the point of a knife and planted in thick lines. The second case was then placed in a light part of a greenhouse, having a north aspect. Under these circumstances the transplanted patches very soon grew rapidly, (whilst those in the case from which they were taken had made little or no progress,) and in six months the second case was filled with a mass of fronds, yet no fronds appeared in the original case. A third case was then prepared, and for the second time small portions were removed from the first case into the new one, and this also was placed in a well-lighted situation, having a north aspect. After being in this third case less than six months a large number of fronds appeared, whilst still no fronds appeared in the original case. A fourth case is now about to be planted from the same original stock, which, although still looking green and healthy, has no fronds developed, and, indeed, the germinal fronds it contains are still little more than mere points. Thus, for three years the growing spores in a darkened corner have remained all but dormant, whilst those transplanted from it have, in a situation of stronger light, a forest of fronds, varying between one inch and six inches in length, according as they have been selected from the second or third cases. This is mentioned as a very curious fact.

* Read before the Biological Section of the Birmingham Natural History and Microscopical Society, December 11th, 1877.

In reverting to the various stages of development from the spore on the frond to the fully-grown plant, most persons have observed what they choose to call seeds on the underside of the frond (though not always necessarily on the underside). They are not, as we have just said, real seeds, but spores, the first process towards the development of a fresh plant. It may be mentioned briefly that about the year 1840 Professor Nageli, of Zurich, announced that he had made the discovery that in the Marchantia-like germinal frond (*i.e.*, whilst in the Liverwort-like condition) were to be seen the organs of reproduction; and in about the year 1845 Count Suminski, of Berlin, confirmed the existence of these so-called Antheridia, and also that two kinds of cells existed on the young germ frond, and that the male cells on bursting threw out spiral thread-like bodies, thickened at one end, and furnished with cilia about the thickened part, and these, from their activity, were called "Animalcules." The Count further stated that he had seen one of these spirals landed in a female cell. Hofmeister has since then distinctly observed the terminal bud of the new axis produced within the pistillidium, (or female cell,) and looked upon the globular cellule in its centre as itself the rudiment of the stem, the embryo originating from a free cell produced within it. Mettenius observed a nucleus within the globular cellule. Mercklin then declared that the spiral filaments swarmed about the pistillidium in numbers, and that he had seen them on rare occasions penetrate it. Professor Henfrey, about 1850, wrote an interesting article on this subject.

Spores, when they are sown, germinate, yet they need not necessarily produce the same form as the frond from which they are taken. In their caterpillar or Marchantia-form stage of life they are said, as before mentioned, to flower, to have male and female organs or cells, (more male than female cells,) and these be it remembered are before there are any fronds, and it seems probable that it really depends upon how this impregnation is effected as to what kind of frond springs up from the germinal frond. The female organs are described as cells, and the male organs as spiral filaments which are tossed into the air, some of which, by landing in these cups, fertilise the plant in its caterpillar stage, and thus enable it to put on its butterfly-life or fronds.

Let an example be taken in the Lady Fern, where a number of varieties have been sown together. Now, if a spiral filament from the variety *Victoriæ* be tossed into one of these female cells, we may naturally expect the fronds when they do appear to be more or less cruciform, like those of the variety *Victoriæ*; whilst if this filament had been thrown from the var. *multifidum* instead, the result would be quite a different plant, a multifid but not a cruciform frond, unless the female cup belonged to a cruciform variety, under which circumstances there would probably result a combination of the two forms. Hence the endless variety that are now to be seen in a good collection. When once an abnormal form has been obtained, it seems only necessary to get a pedigree, *i.e.*, three or four generations, and it becomes almost impossible to raise a seedling of the original normal form; whilst without this abnormal blood it is equally almost impossible to raise any but normal forms.

As regards the various normal forms that species will assume, it is a singular fact that most of our British ferns put on appearances closely in imitation of each other, that the varieties of each species have many characters in common, and that a certain law of form of variety seems to extend more or less through both British and exotic species. The usual forms running through nearly all our British ferns are those having the fronds *crested*, *crisp*, *imbricated*, *confluent*, *multifid*, *acuminate*, *narrow*, *plumose*, *interrupted*, *depauperate*, *ramose*, and *dwarf;* and not only this, but we have the multiple of these, or the com-

bining together of two or three characters in one frond, such as the *narrow-crisped*, the *multifid-crisped*, or the *narrow multifid* as examples. In a wild state abnormal forms are found most commonly where, from various causes, ferns do not grow luxuriantly, *i.e.*, grow under difficulties. When ferns flourish in a high degree, it is almost useless to hunt for abnormal forms.

It seems that spores gathered from one portion of an abnormal frond will produce different varieties from those of spores gathered from another portion of the same frond; so that if an accidental abnormal portion of a frond be fertile it is not impossible to reproduce from its spores plants having fronds in imitation of the accidental abnormal form.

The method adopted by the author of this paper in raising plants from spores is one that can be recommended. Having carefully prepared the soil, and then roasted or boiled it, in order to destroy all animal and vegetable life, it is placed in a Wardian case or pan, having a glass cover. The soil if roasted will require to be wetted with boiled or distilled water in order to be of a proper moistness. It is then pressed until there is a smooth surface, and after this sown with spores, which should not be covered with soil. All watering must be done from below, *i.e.*, the pan placed in a saucer full of water, immersed about one-third of its depth, and this must either be boiled or distilled water, to prevent a confervoid growth on the surface, which would kill the young fern germs. On the surface becoming green with growing ferns, transplant with the point of a knife into much larger pans; and this can be best done by making small indents in the surface, and placing in them small patches of the spores, and lightly pressing each with a finger, taking care to wipe the finger dry after every pressure, or the young plants will cling to it. To procure new varieties, spores are scraped off portions of a number of curious fronds or parts of fronds *of the same species*, and sown thickly together; and the reason for sowing thickly is that the germinal fronds by being pressed closely together by each other become more or less vertical, a position thought to be more easily fertilised by the male organs falling more readily into the female cells than when in a more or less horizontal position, as they would be if sown very thinly. Nature does, to some extent, provide for this by curling the thickened edges; yet under these circumstances, with thin sowing, the male spiral is more likely to be one from the same individual, and would therefore more probably produce a form identical with the parent germ frond; whereas, if the spores of many forms be sown together the chances seem to be much more in favour of the fertilization by another variety being accomplished. After gathering the fronds for spores, it is better to place them in drying papers for a day or two, and then scrape off the spores and sow immediately. Freshly gathered spores germinate much more quickly than those that have been kept for a time.

It has been said, sow together only varieties of the same species, though occasionally, but *very rarely*, two species may be crossed and a *hybrid species* produced. Still, it is so difficult to cross species that we have at the most only a few examples to quote. These instances are probably,—first, *Lastrea remota*, a cross between *Lastrea dilatata*, and *Lastrea filix-mas*; second, *Asplenium microdon*, a cross between *Asplenium marinum* and *Asplenium lanceolatum;* and third, *Asplenium Germanicum* a possible cross between *Asplenium ruta-muraria* and *Asplenium septentrionale.* The author has failed to raise spores from any of these, and is not aware of any one else succeeding, whilst in a wild state the two so-called parents appear always to be growing together where the third form is found.

There are plenty of good-looking spores on *Lastrea remota*, yet they will not germinate. For the last ten years several pans of spores from this fern have been sown yearly without a single plant having been raised.

It has been also a question with the author as to whether some of the forms of species that only bear sterile fronds may not also be hybrid species. All the varieties of the species will reproduce the abnormal forms as prolificly as the normal ones, whilst a so-called hybrid species will not reproduce.

There are not only abnormal varieties of ferns, but the normal forms of different localities differ so that when the common forms of certain localities are gathered together they display in a marked degree the departure from one form.

In nature the progress of change in form is very slow, although in the forms of some plants a more rapid development in some localities can be observed; thus, nearly all the Harts tongue ferns at Westward Ho; on the Castle Rocks, Scarborough; and at Dawlish, are once or twice branched or crested. These changes, however, become much more rapid when under the most favourable circumstances, such as obtaining a pedigree and continuing it.

With regard to the origin of species, it is learnt from the doctrine of evolution, that all are the descendants of a comparatively few originally created simpler forms; this doctrine teaches, (I now quote Sir Joseph Hooker's admirable Botany) :—1st. That the descendant of every plant departs more or less in character from its parents. 2nd. That of these variations, some are better fitted than others, and even sometimes than their parent was, to survive in the area the plant inhabits. 3rd. That the conditions of the area are, like the individuals, variable. 4th. That the number of deaths previous to maturity amongst the descendants is enormously greater than that of survivors, and that these deaths are due to the conditions of the area not having suited them. 5th. That the descendants best fitted to thrive under the conditions of the area will be the survivors. 6th. That these variations will hence ultimately, in certain places, supplant the parent form; and 7th. That the difference between a species and a variety being one of degree only, the variations accumulated through successive generations will become specific, and these again by a like process generic, and so on.

No investigations demonstrate in a more striking manner the truth of the Darwinian theory than such as this paper briefly illustrates. There is undoubtedly a mathematical law in the changes of form, and this fact proves that Dr. Darwin's discoveries have vastly advanced our knowledge of the laws of nature.

ON AN IMPROVED ANEROID BAROMETER.

BY W. J. HARRISON, ESQ., F.G.S.

An instrument which shall accurately indicate differences in level or height above the sea is much needed by practical men of science. The geologist requires it to ascertain the varying heights of his beds of rock, the zoologist and the botanist to know the limits of the zones of animal and vegetable life, and it is of not less service to the meteorologist, the surveyor, the engineer, and the traveller.

The most accurate instrument for this purpose is the ordinary mercurial barometer, arranged in as compact a form as possible, and swinging by the centre from a tripod stand, when it is known as a MOUNTAIN BAROMETER. Even in this form it is, however, of considerable weight, of awkward form, and liable to break.

The HYPSOMETER is a simple instrument, consisting of a thermometer inserted in a partly closed vessel containing a little water, which is made to boil by means of a spirit lamp. Now on a mountain top, the water being under less pressure, will boil at a lower temperature than at the sea level. Thus Tyndall found the boiling point of water on the top of Mont Blanc to be 185° F., showing a lowering of the boiling point of 1° F. for every 590ft. of ascent.

The SYMPIESOMETER, invented by Adie, of Edinburgh, measures pressure by means of a glass tube some 18in. long, closed at one end and bent round at the other. The lower part is filled with glycerine, and by the varying pressure of the outside air on this fluid, the air in the upper part of the tube is compressed or allowed to expand as the case may be, the amount being shown by a scale marked on the tube.

Lastly we have the ANEROID BAROMETER, which consists of a thin, hollow corrugated metallic box, almost exhausted of air, and the lid of which is prevented from sinking too far in by a strong spring which is attached to it. The spring is connected with levers, which move a pointer over a graduated dial. When the pressure of the air increases, the lid of the exhausted box is forced further in and the pointer moves in one direction, and *vice versa* should the air become lighter. All aneroids are graduated by comparison with a standard Mercurial Barometer, and they vary in size from 2in. to 12in. in diameter.

A few months ago it was proposed to attempt the construction of an accurate topographical model of Leicestershire, commencing with the Charnwood Forest district, and gradually adding square by square of the region around until the whole county was shown in relief. The model once executed several casts could be taken from it, and it is intended to colour one of these geologically, and to show river-basins, the distribution of plants, &c., on a second. Such models would teach many important lessons, would be interesting and instructive to everyone, and the very task of construction could not fail to yield valuable results. The best method of executing such models I hope to lay before readers of this journal on some future occasion.

Having obtained a plain Ordnance map of the district we inhabit, if we desire to ascertain the height of the places named thereon, we must refer if possible to some standard. Now the Ordnance Survey published in 1861 an "Abstract of the principal lines of Spirit Levelling in England and Wales," giving to a fraction of an inch the heights of some thousands of stations. In this valuable work are given the heights of many points between Rugby and Leicester, between Leicester and Burton, and between Leicester and Nottingham, which heights are indicated upon public buildings, &c., by means of the well-known bench mark ⩚. The points thus marked would then serve as starting points or for reference, but it is necessary to ascertain the height to within a foot or so of a great many other places, and after a consideration of the various instruments described in the early part of this article, it was determined to use a new form of aneroid, invented by Mr. Rogers Field and made by Casella, and a grant for the purpose was obtained from the Literary and Philosophical Society of Leicester.

Most aneroids have attached to them a scale of feet; in some this is moveable, the altitude being obtained by setting the zero of the scale at the lower station to correspond with the position of the hand, and then

reading off at the upper station only. This cannot give true results, as the scale can only be correct when the zero is in the position in which it was graduated. Aneroids, with *fixed* scales, are correct only at one given temperature, and at one only. It is true that, by using the aneroid as an ordinary barometer, and reading off in inches, we can, by a long calculation, arrive at a correct result, but when some hundreds or thousands of observations have to be made, the process of reduction will evidently be a wearisome one; and if we can read off correctly in feet, at once, it will be a great advantage.

The accompanying woodcut shows Field's aneroid as an instrument 2¾in. in diameter, and a little more than an inch in thickness, thus fitting easily in the waistcoat pocket. Its novelty consists in the fact that the lid marked A A is moveable, and bears nicks, which lock with a pin on the fixed lower case. These nicks are marked from 30° F. to 75° F., and the rim must be moved round until the nick bearing the temperature of the air at the time of observation is fixed by the lock-pin. The scale of feet on the inside of the rim is then correct for that temperature. The altitudes are in all cases determined by taking two readings, one at the lower station and another at the upper, and then subtracting.

Fig. 1.

The principle, in fact, is this: an ordinary aneroid scale is correct at one temperature only, and is incorrect at every other; but "the very fact of the scale becoming inaccurate for the temperature for which it was graduated, renders it practically accurate for some other temperature, so that the shifting of the scale into certain fixed positions answers the same purpose as if the original scale were altered to suit various temperatures of the air."

Another improvement which has been introduced has been the jewelling of the working parts of the interior like a watch, the effect of which has been to increase its sensitiveness in a marked degree, and to render unnecessary the repeated tappings to which an ordinary aneroid must be subjected. It has further been tested and verified at Kew Observatory. A certificate from Kew should be demanded by every purchaser of meteorological instruments, of whatever description. The aneroid thus constructed is not intended to measure very great elevations; indeed, its scale does not extend above 5,000ft., but this permits of reading with accuracy, by means of a pocket magnifier, to 2ft. or 3ft. To set it, we obtain the temperature of the air, by means of a small whirling thermometer, (*thermometre fronde,*) which is slung round the head by a cord, thus giving true shade temperature even under the direct rays of the sun; but this is really hardly necessary, as if it be set approximately within 5° F. a nearly correct result will be obtained.

The following instances may be taken as a fair test of the accuracy and simplicity of this aneroid :—

August 18th, 1877. Temperature of air, 65° F., and scale set accordingly.

	Feet.	
Journey to Derby.—Reading at Leicester Museum	2,167	
,, Town Hall, Derby	2,092	
Difference	——	75

Journey frcm Derby.—Reading at Town Hall, Derby....	2,100	
,, Leicester Museum......	2,185	
Difference..........	——	85
		2)160
Average difference ..		80ft.

Now, the true difference of the heights of these two points, according to the Ordnance Survey, is 78ft., the Leicester Museum being 237ft., and the Town Hall, Derby, 159ft. above mean or half-tide sea level at Liverpool, the error in determination being 2ft. only.

September 5th, 1877. Temperature 60° F.

	Feet.	
Journey to Charnwood Forest.—Reading at Leicester Museum	1,725	
Reading on top of Bardon Hill....	2,395	
Difference............	——	670
Journey from Charnwood.—Reading on top of Bardon Hill	2,400	
,, Leicester Museum..	1,736	
Difference....	——	664
		2)1,334
Average difference....		667ft.

Adding this difference of 667ft. to the known height of the Museum above the sea (237ft.,) we get 904ft. as the height of Bardon Hill, while the height obtained by levelling is 902ft.

MARINE ZOOLOGY AT ARRAN.

BY W. R. HUGHES, ESQ., F.L.S.

In the early autumn of 1873 upwards of twenty members of the Birmingham Natural History and Microscopical Society ventured upon a marine excursion at Teignmouth, on the south coast of Devon. The weather in a somewhat rainy year proved very fine, consequently dredging was pursued daily on board the yacht "Ruby," hired for the purpose, and there were regular botanical and geological excursions in the neighbourhood for those who were minded to go, as well as a special excursion to Kent's Cavern. Upwards of a week was thus passed pleasurably and profitably, many interesting forms of marine life being taken. On the whole the experiment gave such general satisfaction that it was determined to repeat it this year (1877) on a more extended scale, and in a locality which should, as far as possible, offer a decided contrast to that previously visited. The Island of Arran was selected, and the results were equally satisfactory. About twenty members—ladies and gentlemen—formed the party; the arrangements were left to a small Sub-Committee, and, as the number of members was sufficiently large, very favourable terms were granted by the Midland Railway Company, and the luxury of a Pullman Sleeping Car was indulged in at a moderate expense. A small sum—about a sovereign—was contributed by each member to a common fund, and thus a boat for dredging, or a carriage for land excursions, was at the service of the members daily as they felt inclined. An admirable general account of the proceedings having already been given * by one whose kindly disposition and richly-

* "Birmingham Natural History Society. Excursion to Arran."—*Birmingham Daily Post*, Monday, Sept. 10th, 1877.

stored mind did much to add to the social geniality of the party, it is thought that a record of the Dredgings may not be uninteresting here, accompanied by some suggestions for another excursion during 1878. When we arrived at "the Island of the Many Peaks," much difficulty was experienced in obtaining a suitable boat, but eventually we made arrangements with the "Cutty Sark," a herring smack, and the "Mona," a small yacht, both of which did the work very well. The Dredgings, which commenced at the neap tides succeeding the August full moon, were carried on for a week principally in Lamlash Bay, but we had several good hauls both in the Bays of Brodick and Drumadoon. The depths did not exceed about twenty-five or thirty fathoms, and thus it was not found necessary to take temperatures, although we had provided ourselves with one of Negretti and Zambra's "Deep Sea Thermometers," in addition to the "Miller Casella" which we used before, both of which worked well. The results were officially reported to the Society on our return by Dr. Marshall and the writer, at a General Meeting, held on the 18th September last. Mr. John Morley, the Hon. Sec., also alluded to the Botanical excursions which were made under his guidance, and that of the President, Mr. Edmund Tonks, B.C.L. On the present occasion it is not, therefore, proposed to give more than a brief account of the more interesting forms of marine life taken.

The ground which we went over has long been a favourite spot with marine naturalists. Among others of eminence who had been there, we were informed that the late Dr. Landsborough had, with Major Martin, dredged the locality for five years. Our hopes of taking any novelty were not therefore very great. Nevertheless, on referring to the lists in the chapter on Marine Zoology in Dr. Bryce's book, "Arran and other Clyde Islands," (4th edition, 1872,) a charming volume, which should be in the hands of all naturalists visiting the Island, we have reason to believe that two forms, *Thyone* and *Elysia*—to be hereafter referred to—have been added by us to the local fauna. The distribution of marine life was extremely local. Within a few yards each haul of the dredge usually brought up an entirely different series of animals. Sometimes these consisted of the rosy feather star—sometimes of brittle stars—another haul would contain Pectens only—another the nest-building bivalve, *Lima hians*—another the common egg urchin *Echinus sphæra*—another yielded four beautiful specimens of Prideaux's Hermit crab, (*Pagurus Prideauxii,*) with its "commensal," the Cloaklet anemone (*Adamsia palliata*)—another would be of *Melobesia calcarea*, a curious coralline, largely composed of calcareous matter, prettily coloured purple or pink when living, but speedily becoming white after taken from the sea. Sometimes the dredge would contain nothing but mud or sand —to the great disappointment of the dredgers—and on one occasion a common wine bottle came up. It was brought from about twenty-five fathoms, was unbroken, full of sand, and covered with specimens of *Polyzoa* and *Hydrozoa*. As at Teignmouth, in the year 1873, we were too late to observe the developmental processes in the *Hydrozoa;* but it was an interesting fact that, although in point of date we were synchronous with the Teignmouth excursion, when we took several stalked forms of the rosy feather star, (*Antedon* (*Comatula*) *rosaceus*,) not a single specimen was obtained in Lamlash Bay, although every frond of *Laminaria* dredged was diligently searched. Numbers of the adult form were taken in many varying shades of richness of colour. On the whole, our best prizes were in *Echinodermata* and *Mollusca*, but there were several objects of interest in other classes. For instance, in *Porifera* we took specimens of the little calcareous sponges, *Grantia compressa* and *G. ciliata;* in *Zoophyta*, a fine mass of *Antennularia ramosa*; but with the exception of the four beautiful specimens of the Cloaklet anemone, (*Adamsia palliata*,) before alluded to, no other anemones of interest were dredged, nor any corals.

In *Echinodermata*, what immediately struck us on our first hauls of the dredge in Brodick Bay, and again and again in Lamlash Bay, was the gorgeous colour displayed by the lovely star fish, *Goniaster Templetoni* (Templeton's cushion star.) It was of bright scarlet above, varied with cloudy whitish markings, and of straw-colour beneath. When living there is a peculiar viscosity about the animal—the colour soon fades in confinement. But the brilliant colour of this star fish, as well as that of others of the class, served to dispel the popular notion, in those of us whose experience had been limited to a southern fauna, that as one proceeds northward colour diminishes in intensity. The following is a list of the Echinoderms:—*Antedon rosaceus* (the rosy feather star)—many specimens in the free or adult form, taken off Holy Island. In brittle and sand stars we took numerous specimens of *Ophiocoma bellis*, *O. granulata*, and *O. rosula;* also *Ophiura texturata*, *Uraster glacialis*, (the spiny cross-fish,) and *U. rubens*, (the common cross-fish,) the former very fine specimens—the latter in many instances renewing lost parts. *Cribella rosea*, (the rosy cribella,) one specimen, (*two* only are recorded in "Bryce;") *Solaster endeca*, (the purple sun star,) one specimen only, (of this beautiful star fish only *one* is recorded in "Bryce;") *S. papposa*, the common sun star, several specimens. *Goniaster Templetoni* (Templeton's cushion star) was taken numerously, and was most interesting, as indicating the connection—as the late Professor Ed. Forbes pointed out—between the true *Asteriadæ* and the *Echinidæ*, both in the general form and the shape of its spines. *Asterias aurantiaca* (the Butthorn) was represented by one specimen. *Echinus sphæra* (the common Egg Urchin) was taken plentifully; and a few specimens of *Echinus miliaris* (the purple-tipped Sea Urchin). *Echinocyamus pusillus*, (the green-pea urchin,) one specimen only. *Holothuriadæ* were notably absent, if we except a solitary specimen of *Thyone papillosa*, (the common Thyone.) This, which is not in the local list, was most valuable, as showing the passage of the class towards the *Annelida*. The linear arrangement of the suckers peculiar to the class is, in this genus, replaced by a diffused series spreading over the whole extent of the body. In *Annelida* our principal capture was *Nemertes Borlasii*, so graphically described by the late Rev. Chas. Kingsley. *Crustacea* were represented by about twelve species, in which *Stenorynchus* and *Inachus* were conspicuous; all are referred to in the local list. In *Polyzoa* we took *Salicornaria farciminoides*, (alive,) but in this class the specimens were not very numerous—nor were those of the *Tunicata*. In the class *Mollusca*, many specimens were taken which space will prevent recording. The most noteworthy (taken alive) were *Lima hians*, *Scaphander lignarius*, *Dentalium entalis*, and *Aporrhais pes-pelicani*. All these greatly interested us, but especially *Lima hians*. Several "nests" of this remarkable bi-valve were taken, in each case tenanted only by a single individual. The "nests" themselves consisted of comminuted shells, stones, &c., formed into a matted cluster by their byssal threads. When the animals were removed and placed in a vessel of sea water, their great beauty was apparent—some of the tentacles which had become detached remained apparently alive for some hours afterwards, twisting about like small earth worms. In the *Nudibranchiata* we dredged a single specimen of *Elysia viridis*—not recorded in "Bryce." This animal is exceedingly interesting, as belonging to the order *Pellibranchiata*, wherein the respiratory function is effected by the whole surface of the body, which is clothed with vibratile cilia. In the class *Pisces*, which terminates the collection, our most interesting finds were a few specimens of both the pretty little sucking fishes, *Lepidogaster bimaculatus* and *L. Cornubiensis*. They were very small, and the colours were not very well marked. I expect they were immature specimens. One, which was unfortunately lost, exhibited markings of a beautiful pale green colour,

and differed in some other minor respects from the normal conditions of the species.

In the evenings, after our day's work was done, the examination and comparison of our captures afforded great interest to the members; and Dr. Marshall, Professor Keeping, and Mr. Chas. Pumphrey were indefatigable with their microscopes, and exhibited and explained peculiarities of structure and pointed out analogies and affinities.

Such of the specimens as were not required were returned to the sea, and the remainder were put up in spirits and preserved, as a nucleus for our museum.

If, as seems probable, another excursion is organised during this year, it would be desirable, for those interested, to give in their names soon to Mr. John Morley, the Hon. Sec. of the Society, Sherborne Road, Birmingham, so that a meeting may be held in the early spring, and plans determined accordingly. If it is possible to arrange for a week in the month of June, or not later than the first week in July, opportunities would be afforded for the examination of many most interesting forms of marine life in the larval condition, not to be found in the autumn. It is suggested, that if a small steam launch could be chartered for a week, much time would be saved, and dredging might be attempted in deeper water than hitherto. In fact, more work could be done, and it would be done in a better manner. A trawl similar to that which Sir Wyville Thomson states proved so serviceable in the Challenger Expedition might be used as well as the dredge and the towing net. Some shore collecting might also be undertaken with advantage.

LEPIDOPTERA AND THEIR CAPTORS IN THE MIDLAND COUNTIES.

BY THE REV. C. F. THORNEWILL, M.A.

The Lepidoptera of the Midland district have not hitherto received the same amount of attention which has been bestowed upon the same class in other parts of England. It is true that some of the greatest names among practical entomologists are to be found among the midland collectors. The name of the Rev. Joseph Greene must always command respect as that of the great authority on, and almost inventor of, pupa-digging; while another brother of the cloth, the Rev. H. H. Crewe, stands unrivalled in his practical knowledge of the puzzling genus Eupithecia. And another midland naturalist, Mr. Edwin Brown, of Burton, whose collections have lately been dispersed in consequence of his lamented death, stood equally high with either of the above-named for general acquaintance not only with the Lepidoptera, but with Coleoptera, Diptera, and indeed almost every family of the multitudinous race of insects. It is not, then, for want of able and experienced collectors that this district stands below some others, as for example the London, New Forest, and Devonshire districts, from the Lepidopterist's point of view.

Nor again is it for want of sufficient material to work upon. The midland counties include, indeed, many purely manufacturing neighbourhoods, where it is hardly to be expected that Lepidoptera should flourish, (though, for the matter of that, one enthusiastic collector pursues his avocations with great success within a very short distance of the Staffordshire Potteries;)

but it includes likewise some localities which have been, and are likely to remain, amongst the best hunting grounds in England. Cannock Chase, the grand habitat of *G. ilicifolia*, is rapidly disappearing from the list of these localities; but Sherwood, Needwood, and Charnwood Forests still remain to delight the heart and furnish the cabinet of the ardent collector; and the Peak of Derbyshire, with its extensive moors, deep dales, and purling streams, has as yet been very little explored by entomologists. It is quite within the range of possibility that many new habitats, as well as species new to the district, may be discovered by midland collectors, if only they will travel a little out of the beaten tracks, and hunt for themselves, instead of following altogether in the steps of others. There is no assignable reason why the grand "catch" named above—*G. ilicifolia*—should not be found on the moors of North Derbyshire, or why *C. bicuspis* should be regarded as almost confined to the neighbourhood of Burton-on-Trent. The writer of the present article, during a sojourn of about ten days in the Peak in June, 1877, took forty-five different species of Macro-Lepidoptera, some, of course, common enough, but others quite sufficiently good to be worth having in any collection; and this, too, within a very limited extent of country. Nor should it be forgotten that considerably more than half the larvæ of *A. alni*, recorded in the "Entomologist" as having been taken during the autumn of last year, were secured by midland entomologists, the Rev. T. W. Daltry, of Madeley, having taken no less than seven, the Rev. H. A. Stowell, of Breadsall, three, and six or seven others (including the present writer) one each. What is principally needed, in order to secure an efficient and systematic working of the district, is something like union and inter-communication among workers in the same field, which should convert them from a body of irregular skirmishers into an organized army. There are plenty of individual collectors, first-rate localities, and ample materials to work upon. Almost every sub-division of the midland district possesses a Natural History Society, numbering its members from tens up to hundreds. But out of these many—to speak mildly—take but little interest in any branch of natural history, while far more devote their attention to other portions of the study, and the students of Lepidoptera are (generally speaking) few and far between. Even such a society as the North Staffordshire, with its 300 members, reports that in the matter of entomology its entire work for a year has been done by a single individual.

It is hoped, then, that the establishment of the Midland Naturalists' Union, with its annual gatherings, its combined excursions, and—last but not least—its monthly organ in the press, may contribute powerfully towards the existence of a more satisfactory state of things in this, as in all other branches of Natural History. Observers will become cognizant of each other's existence and particular line of study; they will have the opportunity of meeting from time to time on the field or in the annual gathering, and exchanging—as naturalists love to do—experiences of the past, and hints for the future; and many observations, which otherwise might have never seen the light, upon the habits and characteristics of different species, will be permanently recorded for the benefit of collectors and students in general. When we consider how many discoveries have been made, with relation to the habits of our moths and butterflies, during the last few years, and when, too, we find (as we may easily do by the perusal of any standard work upon the subject) how much yet remains to be discovered, it becomes pretty clear that there lies before the entomologists of the midland district an extensive field, upon which they have only to enter to reap a rich harvest of laurels for themselves, and—what is of far more importance—of useful information for all lovers of animated nature.

The president of a certain Natural History Society, in one of the southern counties, remarked the other day, in the course of his annual address, that his society "had exhausted the district!" The accuracy of his remark may reasonably be doubted. But certainly no such opinion could be expressed with regard to this part of the country. Even among the Macro-Lepidoptera, there are several of our local rarities whose "life-history" still remains to be written. The earlier stages of *G. ilicifolia*, if known at all, are so only to a privileged few. *A. niveus*, in spite of the labours of Mr. Brown and others, remains to a great extent a puzzle. *D. bicuspis* would probably be far more frequently found if some competent observer would devote himself to examining into its habits, and informing his brethren 'anent' them. *C. xerampelina*, though probably far from scarce in certain localities, is still looked upon as such, mainly because the majority of collectors are unacquainted with its habits in the earlier stages. And so with many other insects. There is surely something better to be done, in such a field as this, than the mere amassing of a collection. It may fairly be doubted whether a cabinet of Lepidoptera is in itself such a desirable possession. What we really want are observers —men of the stamp of Thomas Edward, the hero of Mr. Smiles' fascinating book—who will note with a keen eye the characteristics of the insects inhabiting their own special locality, and add to the general stock of knowledge by recording their characteristics for the information of their brethren. We hope that many such records as these will find their place, before long, in the pages of the MIDLAND NATURALIST; and, if this be the case, it is certain that our own district will soon be as well worked, and as thoroughly organised for the study of Natural History in all its branches, as any part of England.

FRESHWATER LIFE.—1. ENTOMOSTRACA.

BY EDWIN SMITH, ESQ., M.A.

The Entomostraca, though commonly called "Water-Fleas," are not insects, but crustaceans. They breathe by a sort of gills and the general surface of the body. They have two pairs of antennæ; and mostly more than three pairs of legs, borne by the thorax and abdomen conjointly. They never have wings, or even traces of wings. Consequently it is incorrect to speak of them as "fleas." They are, in fact, little creatures allied to the shrimp and the lobster. With the exception of *Apus*, which is 2½ inches, and *Cheirocephalus*, which is one inch long, the Entomostraca are very small animals, yet not too small to be seen with the naked eye. They are readily picked, with a dipping-tube, out of the jar of water containing them, and are more easily managed in the live-box than the strictly microscopic infusoria. On this account they form a capital first study for any one beginning his researches in freshwater life.

About two-thirds of the British Entomostraca inhabit fresh water, the remaining third being marine. We shall limit our attention at present to the former. The student who is tolerably persevering will soon make out from his gatherings ten or more genera, comprising about a score species, which may fairly be considered common. He should plunge his dipping-bottle into every pond in his neighbourhood, particularly into those which are covered with a green mantle of any sort, under which these creatures like to shelter. A still drain is no bad place for search. The rain-filled cart-ruts on the borders of plantations may also be looked into with advantage. I once took up a bottle-full of water from a small pond in North Wales, which had evidently been shrinking in dimensions all through a dry summer, while the life in it

had been fast multiplying. The water, held up to the light, was literally blood-red with abundance of Daphnia. Though warm days, especially if a little cloudy, are more propitious to the dipping-bottle than cold ones, I have tried my luck with success even in winter, when the ponds were covered with thick ice. A water-trap made in the following way will be found very useful:—A glass jar about three inches wide at the top is fitted with a large bung; the bung has two holes to receive two funnels inserted on opposite sides, one funnel being small enough to go mouth downwards into the jar, and having its mouth covered with a bit of fine muslin. This acts as a strainer, and keeps back the live objects of as many bottles full of water as you choose to pour into the larger funnel.

The Entomostraca are naturally and in the main carnivorous. Indeed, one of their great uses in the economy of nature is to eat up decaying animal matter, which might otherwise taint the air or the water. They appear also to prey upon one another; while they are themselves the food of numerous aquatic animals, beetles, larvæ of insects, and so forth. Common sense will dictate what must be done to keep these little beings in our aquarium for observation. We must retain their food and exclude their enemies. In the struggle for existence amongst themselves the Cyprides appear to have the advantage. Some sprays of *Vallisneria*, *Anacharis*, or *Myriophyllum* should always be placed in the tank, to keep the water fresh, and to afford suitable harbour for the Entomostraca, and for their prey.

The Entomostraca have been arranged in four orders, of which we shall take a series of examples:—

1.—*Ostracoda*, such as Cypris, Candona, &c.
2.—*Copepoda*, such as Cyclops, Canthocamptus, &c.
3.—*Cladocera*, such as Daphnia, Chydorus, &c.
4.—*Phyllopoda*, such as Cheirocephalus.

The aquarium is sure to contain, even when other kinds have disappeared, swarms of active little specks of a bivalve shape, clustering near the glass, and moving about unceasingly amongst one another. Take one out with the dipping tube; you have almost certainly one of the many species of *Cypris*. You observe that the body is nearly enclosed in a loose jacket of two valves joined over the back, leaving the animal free to protrude below the bristly organs by which it swims. Taken out of its jacket or carapace, the body seems pinched up about the middle into two halves, the one corresponding to head and thorax, the other to abdomen and tail. There are two pairs of antennæ; the upper pair being employed for swimming only, the lower for both swimming and walking. Next comes the mouth, consisting of an upper and a lower lip, a pair of mandibles, and two pairs of jaws. The number of legs cannot be stated with certainty. I have noticed only two pairs. Then follows the abdomen, with its two lengthened stalks, each terminated by three short hooks. This is the principal swimming organ, being rapidly jerked out behind for that purpose. Breathing is effected by means of gill-plates attached to the hinder pair of jaws, with some assistance from the feathered bristles of the larger antennæ and the general surface of the body. But there are no branchial appendages to the legs as there are in Daphniæ. *Cypris* agrees with most other Entomostraca in having only one eye. The species most common in the neighbourhood of Nottingham are *Cypris vidua*, *C. minuta*, *C. aurantia*. If you search carefully the surface of gravel in your aquarium you may chance to see a little oblong horny speck making its way by fitful jerks. This will probably turn out to be a rather large member of the same family, named *Candona reptans*. It has the comical habit of creeping in preference to swimming. I have found it about here in meadow drains, and have successfully bred it in my aquarium from season to season.

[TO BE CONTINUED.]

SOME NEW FEATURES IN THE GEOLOGY OF EAST NOTTINGHAM.*

BY J. SHIPMAN, ESQ.

Any one who has seen the Government Geological Survey map of the Nottingham district (71 N.E.) will hardly fail to have noticed two white lines stretching across the north-east of Nottingham. Those white lines mark the course, or what the Government surveyors believed to be the course, of two important faults, or dislocations of the rocks. The white line nearest to Nottingham takes a straight course from Colwick Wood, in the south, to Patchitt's Park, in the north. The other white line describes a parabolic curve, starting from the top of Sneinton Dale, sweeping round by the Hunger Hills and disappearing about midway between Carrington and Sherwood. To the geologist faults are peculiarly interesting, and they sometimes account for a good deal of what is obscure in the physical features of a district. They are the unwritten records of the action, at some remote period in the past, of those natural agencies which we know are ever at work somewhere at great depths, producing oscillations of level in the earth's surface. But, apart from whatever may be the origin of faults, there are some physical features connected with the curved white line which, to say the least, have always been perplexing to those who have cared to pay much attention to local geology. There has hitherto been an air of mystery about it, and nobody was ever able to meet with it at any part of its course. Even Professor Hull speaks disappointedly, in his work on the "Triassic Rocks of the Midlands," at not being able to find the fault just where it was marked to cross Woodborough Road at the end of Red Lane. This fault has hitherto been an object of interest chiefly because it was abnormal for a fault receding at both ends from the fault forming the opposite side of the trough, to help to produce a downthrow of the rocks lying between. It will readily be understood, therefore, why the course this fault really took should be an object of solicitude for years to local geologists. Indeed, I very well remember learning some of my earliest lessons in field geology while trying to trace it; and it was while engaged in the same work in the early part of this year, on account of the unusual facilities afforded by excavations all over that part of Nottingham, that I discovered such serious discrepancies in the Geological Survey's mapping as induced me to resurvey the north-east part of what formed the old borough—that is, the area lying between Mansfield Road, Great Alfred Street, and Coppice New Road, and the result is the map which I now bring before you. In compiling this map, I have necessarily had to fall back, to some extent, on my recollection of what was the geological character of some parts now built upon, and I have found those observations, begun in 1868, very useful in elucidating what would otherwise have been almost beyond reach. The task was far from being an easy one, however pleasant field geology may be. Even where the character of the strata was exposed by sections I found the Keuper, which forms the larger part of the area, extremely difficult to deal with, both in the tracing of faults and in determining the boundary line between the Upper and Lower Keuper. Many spots, too—geologically hallowed ground, ground unusually prolific in interesting points—had to be

* Read before the Nottingham Naturalists' Society, Nov. 28th, 1877. The paper was illustrated with a geological map, sections, photographed sketches of the main faults, the site of the geodes, and of the conglomerate.

visited again and again in order to obtain satisfactory results, chiefly owing to the uncertainty of building operations being begun. Then there was no map published that was on a scale large enough to admit of detailed observations, so I enlarged one to a scale of one inch to 200 feet, which, divided into small handy sections for field use, I found to answer very well. For the levels, without which it would have been impossible for me to have constructed the horizontal sections to illustrate the character of the rocks below the surface, I am indebted to the kindness of Mr. Tarbotton, the borough engineer. No. 1 Section extends from the top of Dame Agnes Street to a point on Blue Bell Hill, north-west to south-east; No. 2, from Hawkridge Street, along Blue Bell Hill, to a point a few yards beyond Belle Vue House; and No. 3, from Great Alfred Street South, along the slope of Blue Bell Hill, to Bombay Street; each to a scale of 50 feet to an inch, and a maximum depth of 220 feet.

Turning now to the new map, perhaps the most striking feature is a broad, ribbon-like band of Keuper marl, shut in on each side by two parallel white lines, stretching across the map from the south-east to north-west. Those white lines are the equivalents of the straight and the curved faults respectively of the Government map. The fault nearest to Nottingham I have, for convenience, called No. 1 fault; the equivalent to the curved fault is No. 2. No. 1 fault, you will observe, has the effect of bringing down the Lower Keuper marl (f5) alongside the Bunter sandstone (f2) all along its course after leaving Blue Bell Hill, where the outcrop of the Keuper is on the south-west side of the fault. This fault strikes N.W., but before reaching Mapperley Road it seems to become deflected, bearing N.N.W., through Patchitt's Park, and joining No. 2 fault somewhere near the bottom of Red Lane, while only a minor dislocation is found taking the north-westerly course. Both faults throw down the Lower Keuper marl, the N.N.W. fault being well seen breaking through the east end of the sandstone cliff and bringing down the Lower Keuper twenty or thirty feet. Beyond No. 2 fault, that is on its north-east side, instead of the three-cornered inlier of Bunter (f2) which appears on the Government map, we have a double tongue of Bunter stretching up towards the Westminster Abbey, (as on the Government map,) on the one hand, and forming the valley at the foot of the Hunger Hills on the other—evidently the extremity of a broad offshoot up the St. Ann's Valley from the main area of Bunter to the south-west. We thus find that what the Geological Surveyors supposed to be a curved fault turns out to be a parallel fault to the straight one, striking about 55° west of north. This fault was exposed during the excavations for lowering Mapperley Road, near the reservoir, some years ago, then at the top of Dame Agnes Street, again half-way down that street, where it crosses obliquely, and may be traced passing down Martin Street and through the field where the St. Ann's Flower Show is held, across the hills to Carlton Road, where it is again seen at the elbow turn, and also in a section off Crown Street, opposite. It appears to have a throw of about 95ft. in Dame Agnes Street, increasing slightly further south, throwing down the Upper Keuper alongside the Lower, and the latter level with the Bunter. When cut through in Dame Agnes Street this fault was found to hade to the south-east, just as we should expect, considering that it unites with No. 1 fault, which hades in the opposite direction, to let in a sort of broad wedge of clay rocks belonging to a higher level; and the space between the walls of the fault was filled with pebbles embedded in a crystalline calcareous red sandy matrix, associated with red marl and "skerry." Acting as a sort of connecting link between the two main faults, and shifting the boundary line of the Upper Keuper about four hundred feet, is a fault familiar enough to most of us on account of its being long exposed in the section of marl opposite

Cranmer Quadrant, where it is seen bringing down the lower beds of the Upper Keuper alongside the marlstones of the Lower Keuper. This fault strikes north 40° west, with a throw of apparently about 15ft.; it is not again seen. It so much resembles No. 1 fault, as seen on Blue Bell Hill, that one can scarcely wonder that, in the absence of more complete data, the Survey should have regarded it as a continuation of the same fault. Reverting to No. 1 fault, it evidently forms quite a focus of small dislocations on Blue Bell Hill, varying in direction between west and north. One of these, bearing 10° north of west, and throwing down the Lower Keuper against Bunter about 10ft., produces the triangular patch of Bunter, just at the apex of which were a few feet of Lower Keuper capping the Bunter. When these beds were cut through during the formation of Turner Street, a remarkably interesting section of the conglomerate at the base of the Lower Keuper was exposed.* Unfortunately, however, it has since been removed for building purposes. Another fault, having a down throw of 6ft. 3in. on the east side, is traceable crossing Blue Bell Hill Road 12° west of north, and coming out in the cliff in Lower Beacon Street. The other minor dislocations marked on the new map, mostly parallel with this, all have a downthrow to the east, but they are of no further importance than to serve to show the general tendency of the down-throw of the faults on Blue Bell Hill, east of No. 1 fault. In fact I met with more dislocations radiating from No. 1 fault than in any other part. I ought not to omit to mention that No. 1 fault is finely exposed in the section opposite the saw mills on the Blue Bell Hill Road. The Lower Keuper between Pease Hill Road and the Robin Hood's Chase is also much disturbed by faults. Two or three may be seen in the brick yard there, but others, having a downthrow to the north-east, probably exist; for, on the down-throw side of No. 1 fault at the junction of Cooper Street and Pease Hill Road, the Bunter was met with at a depth of 16 feet, while near the Chase, with a rise of ground of about 14 feet, the Bunter was not reached till a depth of 54 feet of Lower Keuper had been passed through, and then only on the upthrow side of a fault which was found to cut through the well. Again, just where we might expect to find the lowest beds of the Keuper, namely, at the bottom of Dame Agnes Street, over 40 feet of waterstones have been pierced without reaching the Bunter. This, coupled with the fact that brickyards existed years ago along the bottom of Blue Bell Hill on St. Ann's Road, leads me to infer the existence of a series of transverse faults running nearly parallel with that road, and letting in the higher beds of the Keuper.

While tracing the fault I have mentioned in the Beacon Street Cliff, I came across some very interesting geodes in the Lower Keuper sandstone beds. The geodes ramified in the thick beds of sandstone without any regard to the lamination; were lined with rhombohedral crystals of calcite, occasionally tinged with copper and a black mineral—probably manganese; and appeared to have been formed long after deposition and consolidation of the rock. The crystals were all rhombohedrons, except where the copper or the black substance was present, when they became double six-sided pyramids. These are the first crystals of calcite, as far as I know, that have been found in the Keuper—at least in this district. The geodes extended through about three feet of the marlstone, and were confined laterally to the space of a few square yards. The calcareous matter appeared to have come from above, a thin lenticular band of it, about three feet long, being met with about five feet above where the geodes were found.

[TO BE CONTINUED.]

* This conglomerate is described at a later stage.

Correspondence.

The Nest of a Sparrow, *(Passer domesticus,)* containing six eggs, was taken at Saltley, on the 30th of November. It is now in the possession of Mr. A. F. Shrive, 98, Lower Tower Street, Birmingham, where it may be seen by anyone interested in ornithology.

Leicestershire Flora.—The Natural History Section of the Leicester Literary and Philosophical Society is engaged in verifying and bringing up to date the MS. of the Flora of Leicestershire, left by the Rev. W. H. Coleman, of Ashby, about twenty-five years ago. Any botanist in the outlying districts of the county will be rendering useful assistance by sending lists of plants observed to the President of the Section, at the Town Museum, Leicester.

Magpie—Cuckoo.—A friend of mine who, as a boy, was a great hand at bird's nesting, and also a great observer of the habits of birds, has remarked that when a magpie built its nest in a larch or fir tree, and the nest was taken with a full complement of eggs, she would invariably build again near the same spot. But if the nest was taken under the same circumstances from an oak, elm, or other forest tree, she would never rebuild in the same neighbourhood. I should be glad to know, if any one else has remarked this, and if it can be accounted for. Also, if it is a generally acknowledged fact, that the cuckoo lays its egg on the ground, and carries it to the nest where it is to be hatched.—Oswald M. Feilden.

Conchology.—It may be interesting to your Conchological readers to learn that two species of shells not previously known to exist in Warwickshire have been recently added to the fauna of that county. Whilst searching for *Pselaphidæ*, in moss growing on a poplar tree near Knowle, the writer found a single specimen of *Zonites excavatus*, var. *vitrina* Fer. This species is interesting from its habit (unusual with snails) of braving the most inclement weather, being often found crawling on snow. Near Henley-in-Arden in the heart of Warwickshire, the turnpike road has been cut through a hill composed of red marl, and on the banks of the cutting, on both sides of the road, *Helix Cantiana*, Mont., abounds. The writer found it there during a Summer Excursion of the Birmingham Natural History Society, but has not discovered it in any other part of the county.—W.G.B.

A Suggestion for Naturalists.—Having in the early part of this year set on foot a Naturalists' Society, called "The Northwich Naturalists' Field Club," we are very anxious to establish a series of lectures on Botanical and other Natural History subjects, to be delivered during the winter months for the purpose—first, of instruction to the Class; second, of increasing interest in such subjects; and third, of aiding the funds—as we are at present very poor. The announcement of the "Midland Naturalist" has suggested to me the idea of soliciting through its pages the *gratis* services of some of the members of the Midland Union of Naturalists in the delivery of monthly lectures, trusting that there may be some who, out of love for the objects and a desire to extend the study of Nature, would be willing to deliver such lectures to our Society here without further remuneration than their necessary expenses. Our Society is in an *infant* state, and therefore the lectures need only be plain and elementary in their nature. If you would assist me by printing this letter I should feel very grateful, and it would be a great assistance to the work which we hope to carry on here.—T. Hartley, Curate of Witton, Northwich, Cheshire, Hon. Sec. of N.N.F.C.

Note on a Curious Beetle.—Presuming that the occurrence of the less common species of insects in our Midland district will be a matter of interest to the readers of the "Naturalist," I send the following note:—On the 12th of September, 1873, a young friend of mine brought to me from the newly-opened Clifton Colliery, near Nottingham, some specimens of a remarkable beetle. Its entire length, body and head, was $\frac{5}{8}$ of an inch; its prevailing colour an iron gray, with lighter patches on the thighs and tarsi, and lighter strokes between the segments on the under side of the abdomen. But the most striking feature about the beetle was its antennæ. These were $3\frac{1}{2}$ inches long, composed of ten joints, the one nearest the head being much thickened. How this little creature manages to fly through the woods without breaking such long and slender organs is a puzzle. They are longest in the males; and as the males, so I am told, frequently fight, the antennæ do get broken. Several specimens were brought to me in this state. The beetle in question I made out to be *Astinomus ædilis*. Some authorities call it *Acanthocinus*. It appears to occur at Rannock, in Perthshire; and Mr. Rye says that "it may be not uncommonly seen flying across the glades of the Black Forest, with its long appendages streaming behind. It loves to settle on felled pine logs, with its antennæ spread out like compasses, from which habit it is termed by the Highlanders "Timber-man." There seems to be no doubt that the beetle was imported in the timber needed for the colliery, and travelled from its proper home in the stage of larva or pupa. Waking from its quiescent state, it flew, attracted by the warmth, in great numbers to the tall chimney of the engine house, where several very fine specimens were secured. For a good figure see Rye's British Beetles, plate xiii.—Edwin Smith, Nottingham.

A Few London Notes, by an Occasional Correspondent.—Now that the season for the work of the learned societies has come, they are as busy and interesting as usual, and as admission is easily obtained to any or most of them, the subscribers of "The Midland Naturalist" cannot do better, when they are in town, than consult "The Weekly Calendar" of the *Illustrated London News*, and, choosing their society, ask a member for an introduction.—A great want in microscopy is likely to be supplied by the "Immersion Paraboloid," exhibited at the Quekett Club, which renders dark ground illumination possible with high powers. It is, being "immersion," somewhat more troublesome than the ordinary illuminator, but answers admirably.—Every one will be glad to hear that Sir Josh. Hooker is looking strong and well after his tour. He visited Colorado and the Sierra Nevada, with Professor Asa Gray, with the intention of classifying the Conifers on their route. The task is rendered difficult by every tree having as many local or scientific names as branches; but among other curiosities, he mentioned one pine which does not shed its seeds or cones, and showed a specimen of another and a piece of juniper, deeply scored and honey-combed in parts, to the depth of thirty annual rings, by sandblast. Considering the trees were grown at an altitude of some thousands of feet, and are so hard that a knife will not touch them, it can be easily imagined, as is the fact, that hundreds of years have been spent in making the excavations.—Professor Tyndall's lecture, at the London Institution, was a great success, the Theatre not being nearly large enough to hold the intending audience. His proofs, in opposition to Dr. Bastian's assertion of spontaneous generation, seemed unanswerable; but the Doctor is too tough an antagonist to be easily vanquished. In passing, I may remark that if scientific lecturers generally only knew the pleasure it gives an audience to listen to the fluent and animated delivery of Professor Tyndall, as opposed to the sing-song, monotonous *read* lectures, only too common, they would cultivate style as they do their other gifts, and doubtless as

successfully. For fun, commend me to Dr. M. C. Cooke. We who had the privilege of attending the Quekett Club Dinner on the 1st will not easily forget his description, "*a la* Hood," of the Chinese Ambassador's visit to the *soirée*. The Dr. said "He brought his own China mug to tea," and he admirably described his surprise when he saw a flea under the microscope.—The Aquarium, at Westminster, is now well worth seeing, the tanks being fully stocked and the water bright. The latest addition—the Sharks, in the largest tank, are vigorous, and give us a good idea of the Squalidæ. Mr. Carrington, the naturalist, who has now the management of the fish department, has reduced the former terrible mortality of his *proteges* to an almost nominal rate, and may make the people of Birmingham hopeful of the future of their Aquarium when they see what difficulties have been overcome. Mr. Carrington is on a tour in Italy, and, as he purposes dredging on the Sicilian coast, and visiting Dr. Dohrn's most admirable of all Aquaria, at Naples, there will doubtless be something to see at Westminster, on his return, notwithstanding the loss of Pongo and the Whale.—W. J. S.

Gleanings.

Mr. Charles Darwin, the great Naturalist, has had the degree of Doctor of Laws conferred upon him by the University of Cambridge.

The Scotch Naturalist.—From a letter we have received from Banff, we learn that Thomas Edward is busily occupied in preparing for publication further reminiscences of his life and labours as a naturalist. We are sorry to learn from our correspondent that he is suffering from bad health.

The Bakerian Lecture was delivered before the Royal Society, (Sir J. D. Hooker, President, in the chair,) on the 15th November, by Prof. W. C. Williamson, the subject being "On the Latest Researches into the Organisation of the Fossil Plants of the British Coal Measures, especially of the Calamites and Lepidodendra."

The Beginnings of Life is the title of the first of the Manchester Science Lectures of the current Session. The lecturer is Professor P. Martin Duncan, F.R.S.

The Royal Society's Medals for the year 1877 have been awarded thus:—The Copley Medal to Professor James Dwight Dana, for his biological, geological, and mineralogical investigations, and for the valuable works in which his conclusions and discoveries have been published; to Mr. Frederick Augustus Abel, F.R.S., a Royal Medal, for his physico-chemical researches on gun cotton and explosive agents; a Royal Medal to Professor Oswald Heer, of Zurich, for his researches and writings on the Tertiary Plants of Europe, of the North Atlantic, North Asia, and North America; and the Davy Medal (first time of its award) to Robert Wilhelm Bunsen and Gustav Robert Kirchoff, for their researches and discoveries in spectrum analysis.

Chara Fragifera.—The discovery of *Chara fragifera*, (Durieu,) as a British plant, by Mr. John Ralfs, in a peaty pool, at Chy-an-hal, near Penzance, Cornwall, is recorded in the last number of the *Journal of Botany*.

Hybrid Brambles.—In the *Journal of Botany* for December, there is an interesting paper, by Dr. W. O. Focke, on "Some Hybrid Brambles," in which the author gives an account of his experiments in crossing the nearly allied varieties—*Rubus gratus* and *R. bifrons*, by which he has obtained a plant which he considers to be identical with *R. Villicaulis*. He says, "Now the question arises, what is the widely distributed *R. Villicaulis?* Is it, indeed, a constant race derived from a hybrid? It is not easy to understand how this can be the case, as *R. gratus* and *R. bifrons* grow scarcely anywhere at the same spot. In the greater part of Germany, where *R. Villicaulis* is abundant, and probably also in England, there is never seen either of its supposed parents." He has also succeeded in producing hybrids by fertilisation of *R. Idæus* L. and *R. Bellardi* W. and N., with the pollen of *R. Cæsius* L. The products are quite sterile, and that of *R. Idæus* resembles the spontaneous hybrids described as *R. Cæsio-Idæus*, &c.

Zoological Society.—Amon the additions to the Society's menagerie during the months of August, September, and October are a Cape hedgehog, *(Erinaceus frontalis,)* a young American tantalus, *(Tantalus loculator,)* a Brazilian marmot, *(Momotus brasiliensis,)* two Guilding's amazons, *(Chrysotis guildingi,)* two sooty coots, *(Fulica ardesiaca,)* and a pair of African buffalos, *(Bubalus æquinoctialis,)* acquired by purchase.

Rare Birds.—The Rev. F. O. Morris, Nunburnholme Rectory, Hayton, York, has drawn public attention to the necessity of something being done to protect birds which yearly or occasionally visit our shores "who come to us, but never return again whence they came," being ruthlessly shot as soon as seen. He mentions the hoopoe, the blue-breast, the golden oriole, the roller, the bee-eater, the Orphean warbler, the great sedge warbler, the melodious willow warbler, and the Alpine warbler, the chough, the rose-coloured starling, &c., as some of the birds he would desire to have protected in order that they might have a chance of building, breeding, and so becoming naturalised among us, "as beyond all doubt some of them would if they were not destroyed."

The Challenger.—Measures are afoot for supplementing the researches of the Challenger Expedition by a series of deep-sea dredgings in the Indian Seas. These seas were purposely omitted from the scope of the Challenger's investigations. A new steamer is now being built in India, and an officer of the Coast Survey Department (Lieutenant Jarrad, R.N.) has been commissioned to see after the fittings and dredging appliances in England. Full information has been obtained from the old staff of the Challenger, and it is hoped that operations may be started next cold season (1878-79.) In that case it is probable that the first steps will be to run one or more lines of soundings across the Bay of Bengal in such directions as may seem best.

A fossil *Peronospora* of the Palæozoic age is described and illustrated by Mr. Worthington G. Smith, in the *Gardeners' Chronicle* of October 20th. It is the remains of a fungus found growing in the vascular bundles of a *Lepidodendron* from the coal measures, and the name he gives it is *Peronosporites antiquarius*. A criticism on the subject will be found in *The Academy* for November 17th, p. 475.

The Telephone.—At a recent meeting of the Society of Arts, Professor Graham Bell, the inventor of the telephone, gave an interesting account of the experiments by means of which he had arrived at the instrument in its present form, which, if not absolutely perfect, is rapidly

tending thitherwards. The instrument was employed on the occasion successfully. To carry on a sustained conversation, it is found that two instruments are required at each end, one to speak to and the other to listen at.—A full report will be found in the *Times* of November 29th, p. 6.

THE PHONOGRAPH is the name of an instrument, invented by Mr. Eddison, which is described as an improvement on the Telephone. The inventor has provided an arrangement, by which the undulations produced by the human voice are recorded on a strip of paper, from which the sentences uttered may be reproduced automatically.

OUR COVER.

BY WORTHINGTON G. SMITH, F.L.S., M.A.I., &c.

Every work of art, whether important or unimportant, should be able to speak for itself, and tell its own tale. It has been suggested, however, that the designer and engraver of the new Cover of the "MIDLAND NATURALIST" should write a few lines of description of the picture on the outside wrapper, and he has complied, with pleasure, by writing the few brief sentences which follow:—

Some of the ideas for the Cover belong to Messrs. Badger, Tait, and Harrison, others are the writer's; the general design is intended to give a sort of conventional reflex of the chief Sciences. The study of animals recently extinct is indicated by the sketch of the Mammoth, *(Elephas primigenius,)* in the ice, and of living animals by the drawing of the Red Deer, *(Cervus Elaphus.)* The philosophical instruments at the top, spectroscope, microscopes, and telescopes, need no word of explanation. The Cromlech, flint arrow-head, and stone hammer point to pre-historic Archæology; the Cromlech represents the magnificent monument still standing near the village of Clynnog, in Carnarvonshire. The cap stone of this Cromlech is profusely dotted over with the enigmatic "cup-markings;" the original sketch for this outline was made by the writer from the actual structure in August last. The botanical vasculum, the geological hammers, anemometer, ground thermometer, barometer, and rain gauge point to the respective studies in which these instruments are used. The Bee *(Bombus terrestris)* is introduced as a typical British Insect to represent Entomology, and the Wild Rose, *(Rosa canina,)* and Cowslip, *(Primula elatior,)* are given to indicate the Phanerogamous section of Botany. The Actinophrys, *(Actinophrys Eichornii,)* on the right points to the Rhizopoda, and the Ferns and Fungi beneath are representatives of Cryptogamic Botany. The Apteryx, *(Apteryx Australis,)* and Octopus, *(Octopus vulgaris,)* represent rare and curious animals, and at the same time point to Ornithology and the Mollusca. The Ichthyosaurus at the base is a representative of animals long extinct, and now found in a fossil condition only.

As there is always an interest attached to the method of doing things, it may not be out of place here to say that the design, (with all its defects,) was drawn direct on the box-wood block, and engraved at once, without a slip, false line, or alteration. Many readers of the "MIDLAND NATURALIST" will probably be self-taught men, who busily follow industrial occupations every week-day. It may therefore interest such readers to know that the writer of these lines never had any teacher, either artistic or scientific, other than he always found supplied to him by close observation, careful reading, experience, and constant perseverance.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—General Meeting, November 6th. The President, Mr. Edmund Tonks, B.C.L., in the chair. Dr. W. Hinds read a short paper on the "Physical Character of Seeds," referring to the form, beauty of markings of the testa, style, and deposition of the embryo; the indication and inferences to be derived from the presence of perisperm, and especially as to comparative and absolute size of albuminous and exalbuminous seeds. The aim of nature in furnishing certain seeds with characteristic appendages was also commented upon. The paper was illustrated by microscopical and other specimens.

Biological Section.—November 13th.—Dr. W. Hinds presiding. Mr. W. B. Grove, B.A., gave some remarkably interesting notes on the "Botany, Geology, and Physical Geography of the Cheshire and Lancashire Coasts," illustrated by geological diagrams and a series of carefully preserved botanical specimens. These formed a very characteristic flora of the above coasts. Among others were *Psamma arenaria*, *Festuca uniglumis*, *Carex extensa*, *Viola Curtisii*, &c. A discussion followed.—Mr. J. Bagnall exhibited a number of rare Warwickshire plants, collected in a rich lias quarry, near Bidford and Exhall, and read notes as to the distribution of these plants in the country and throughout the world, together with the origin and signification of their names, and a short account of some of the older botanists by whom these names were first instituted. Among other plants were *Linaria spuria*, *Anagallis cerulea*, *Picris hieracioides*, &c.—Mr. John Levick exhibited in the microscopes selections of water from a prolific pond, near Perry Barr, in which were abundant *Volvox globator*, *Actinophrys sol*, and other creatures of great interest.

Biological Section.—December 11th.—Dr. W. Hinds presiding.—Mr. E. W. Badger read a paper on "Abnormal Ferns," by Mr. E. J. Lowe, F.R.S., of Nottingham, which will be found printed at length at page 5. An animated discussion followed. A vote of thanks was awarded to Mr. Lowe for his valuable and interesting communication.

Geological Section.—October 30th.—Mr. Heming, of Redditch, read a paper on "Agates," collected from the drift in the neighbourhood of the Lickey. The greater part of the gravel which yields the agates comes from the Moseley cutting, and some isolated patches usually capping slight hills. All these gravels are characterised by hollow nodules of iron ore. Mr. Heming made some remarks on what he held to be the origin of some irregularly marked agates, viz., the chert of the Carboniferous Limestone. The paper was illustrated by many beautiful polished specimens of pebbles.

Geological Section, November 27th—Rev. H. W. Crosskey, M.A., F.G.S., presiding. Mr. S. Allport, F.G.S., showed specimens of Volcanic Agglomerate and blocks of Porphyritic and other Pitchstones, from the Wrekin; and Spherulitic, Pitchstone, and Perlite, from Lea Rocks, also near Wellington. These rocks have been described in the *Quarterly Journal of the Geological Society*. They are chiefly remarkable as being the first glassy rocks of Palæozoic age which have been anywhere found. The blocks of Pitchstone occur in certain of the higher beds of the Agglomerate, and are of considerable size, from 14 to 18 inches in diameter. Mr. Allport gave a description of the Volcanic rocks which form the central axis of the Wrekin, and exhibited some beautifully-prepared microscopical sections, illustrating his remarks.

General Meeting, December 4th.—Mr. S. Allport, F.G.S., presiding. Mr. Levich read a paper on "The Hydra," describing its mode of reproduction, and its stinging organs, and made some interesting remarks upon its habits, and the manner in which it seizes its prey. The paper was illustrated by several specimens under the microscope, amongst which were the stinging organs, and a specimen of *H. Vulgaris* with ova attached. The same evening Mr. W. R. Hughes, F.L.S., read a paper on "The Spicules of Sponges." After referring to the vexed question of the animality of sponges,

which had been satisfactorily settled in our day, both by the physiologist and the chemist, he described the mode of life of the animal. The manner in which earthy matter, calcareous or siliceous, was secreted, in order to give strength and consistence to the tissues, was then alluded to, and the various offices performed by the spicula—connecting, prehensile, defensive, tension, and retentive, were described. The spicula themselves, which are of the most varied and beautiful kinds, resembling spun glass, extend from the simple pin-shaped to the elaborate cruciform and anchorate forms as seen in the *Hexactinellidæ*, and are amongst the choicest objects in the cabinet of the microscopist. Between two and three hundred of these forms had been described by the late Dr. Bowerbank, the historian of the British *Spongiadæ*, and several new and beautiful forms which were alluded to had been added by the deep sea explorations of H.M.SS. Lightning, Porcupine, and Challenger. The paper was illustrated by a series of very beautiful diagrams executed by Miss Hadley, one of the members of the society, and by many specimens from Mr. Hughes's cabinet. One of the diagrams exhibited an Anchorate spiculum, enlarged 22,000 diameters. Mr. Wright Wilson, F.L.S., exhibited specimens of the *Euplectella aspergillum*, or Venus's flower basket, and of the *Hyalonema mirabilis* or glass rope sponge, and also, as a contrast, specimens of spun glass in further illustration of the paper.

BURTON-UPON-TRENT NATURAL HISTORY AND ARCHÆOLOGICAL SOCIETY.—October 31st, *soirée;* papers by Mr. J. T. Harris, the Rev. C. F. Thornewill, M.A., and Mr. C. Perks. November 13th, paper by Rev. W. W. Fowler, M.A.; subject, "The Colorado Beetle." November 27th, paper by Lawson Tait, Esq., F.R.C.S.; subject, "Insectivorous Plants," an abstract of which will appear in the "Midland Naturalist." December 11th, paper by Rev. T. F. Fenn, M.A.; subject, "Holiday Rambles."

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.—NATURAL SCIENCE SECTION.—The following papers were read:—December 5th, "On the Geology and Mining History of Coal," by Mr. J. Bilbie. December 12th, "On the Oldest Welsh Rocks," by Mrs F. M. Ward. December 19th, "On Teredos, or Wood-boring Mollusca," by Mr. B. Sturges Dodd.

NOTTINGHAM NATURALISTS' SOCIETY.—November 28th. Meeting at the Corn Exchange, Thurland Street. Mr. Shipman read a most interesting paper, entitled "Some New Features in the Geology of East Nottingham," the first half of which appears in our current number. (See p. 18.)—December 5th. Meeting at the Museum, Wheeler Gate. Mr. B. S. Dodd read a paper on "Algæ," dealing with their habitat, structure, economy in nature, &c., and also the readiest way of preserving them as cabinet specimens. The paper was illustrated by numerous well-mounted specimens from the Channel Islands.—December 19th. Meeting at the Museum, Wheeler Gate. A rough "Sketch of the Geology of Nottingham and the District" was given by Mr. C. T. Musson.

OSWESTRY AND WELSHPOOL NATURALISTS' FIELD CLUB.—This Society made four excursions during the summer of 1877—the first in the neighbourhood of Montgomery, a very beautiful district, abounding in ancient remains, camp, tumuli, castles, &c., and a good field for botany and geology. The next excursion was along the Dee from Overton, through Wynnstay Park to Ruabon. The third was to the Breidden, rich in botanical treasures, but it being rather late in the season, only *Sedum Forsterianum* was found. The last excursion was to Wenlock and Buildwas Abbey, and the Wrekin. The only other plants of any rarity which have been found this summer, are *Inula Helenium* and *I. Conyza*, *Scabiosa Columbaria*, *Sedum Telephium*, *Linum Augustifolium*, and *Utricularia Vulgaris*.

STROUD NATURAL HISTORY SOCIETY.—The second meeting for the present session was held on the 13th November. There was a large attendance. Mr. J. E. Dorington, president, in the chair. A short paper was read by Dr. Partridge, F.R.M.S., "on the application of the microscope to scientific inquiry."

The meeting then resolved itself into a conversazione, and an exhibition of microscopic objects, &c. Mr. Allen, of Bath, Secretary to the Postal Microscropic Society, lent an antiquated form of instrument for exhibition, and also sent some excellent slides and MS. containing beautiful drawings by Tuffen West, Hammond, Winderhill, &c. On December 11th, at a numerously attended meeting, the President in the chair, J. H. Taunton, Esq., C.E., read an important and interesting paper on "The enlarged use of compressed air in recent engineering construction;" Dr. Bond, of Gloucester, exhibited a telephone in working order, and described its construction and mode of use; and Mr. Holland exhibited various liassic specimens from the bone bed, near Westbury.

TAMWORTH NATURAL HISTORY, GEOLOGICAL, AND ANTIQUARIAN SOCIETY.—The annual meeting was held December 17th. After the statement of accounts and the report had been read, the President (Mr. R. W. Nevill) delivered a valedictory address, in the course of which he reviewed the social changes which have taken place during the last quarter of a century, mentioning briefly, but clearly and forcibly, the more important of them. He next pointed out that the progress of science during the same period had been even greater. Reference was then made to some of the many important investigations now occupying the attention of our leading men of science; and to the recent discovery of the telephone by Professor Bell. After thanking the members for their attendance, Mr. Nevill proposed for his successor as President the Rev. Brooke Lambert; the motion was seconded by Mr. W. Lucy, and carried unanimously. The Committee, Treasurer, (Mr. H. Thring,) and Secretary, (Mr. W. G. Davy,) were then elected. The meeting was afterwards occupied in examining a telephone, which was exhibited and successfully worked.

Answers to Correspondents.

F. T. M. "Mathematical Problem."—We have submitted your question to two able mathematicians—one a Senior Wrangler who has made optics a special study—who agree in stating that in the present state of our knowledge it is unanswerable.—We shall be glad to be favoured with your promised contributions.

Melicerta Ringens.—In answer to H. M.'s enquiry, we refer him to an advertisement on the cover of this month's issue, in which he will see that he can obtain for a mere trifle from Mr. Thomas Bolton, of Hyde House, Stourbridge, specimens of this interesting building Rotifer. Mr. Bolton has long been recognised in this locality as a most successful finder of rare Rotifers, Entomostraca, &c.

We have to thank many friends for encouraging communications. We have especially to thank Dr. W. Hinds for his excellent article on "The Chlorophyll-body and its relatien to Starch;" Mr. W. G. Blatch for his interesting communication on "Entomological Books for Beginners," and Mr. C. T. Musson for his "Catalogue of the Land and Fresh Water Shells to be found in Nottingham and the neighbourhood," for all of which we hope to find room in the number for February.

We have much pleasure in printing the following resolutions, unanimously agreed to at the last meeting of the Birmingham Natural History and Microscopical Society:—Resolved—That the Secretary be requested to send a copy of the first number of the "Midland Naturalist" to all the members of this Society, accompanied by a circular calling their attention to the journal, and expressing a hope that they will subscribe. Resolved—That this resolution be communicated to the other Societies in the Union, in the hope that they may be induced to take similar measures to bring the "Midland Naturalist" before the notice of their members.

PASSAGES FROM POPULAR LECTURES.

BY F. T. MOTT, F.R.G.S.

No. 1.—THE MEANING OF "SCIENCE."

Let us consider what we understand, and what we ought to understand, by the word "Science." The word itself is simply the Latin word *Scientia*, stripped of its Roman toga and put into an English dress. Its original meaning is "knowledge," and the Romans used it in its widest sense, as including all manner of facts and propositions which were known or supposed to be known. But in later times its meaning has been restricted. The domains of art and of literature have been struck out from the domain of science. In our modern view science deals with principles, art with practice. Science enquires about the laws of matter and mind, art applies these laws in the production of results. To ascertain the laws of animal life and of inherited qualities is science; to improve the breed of sheep and cattle by the application of this knowledge is art. But the domain of science is still very wide, and is further broken up by modern analysis into such sections as "pure science," dealing with abstract ideas; "physical science," investigating nature mathematically; and "natural science," studying the laws of life. Yet there is another analysis which requires to be made, and which seldom *is* made by those who speak of science in a popular manner. Science, we say, means "knowledge:" but what do we understand by "knowledge?" Under cover of this word are commonly confounded two very different states of mind, and the confusion has led to many serious results.

If we say that we *know* there is light in this room, and that we *know* the light is produced by the gas, we are speaking of two quite different kinds of knowledge, only one of which has any right in a strict sense to be called knowledge at all. The other is not knowledge but *belief.*

We *know* that there is light in this room; but we do *not* know that it is produced by burning gas; we only *believe* that it is.

Mark the difference. Knowledge is that of which the mind has direct perception. Belief is that state which the mind arrives at from the balancing of evidence.

That there is light here is not a matter of inference, or judgment, or opinion; it is not a conviction arrived at from weighing evidence; it is the simple perception of a sensation. There can be no possibility of denying it. It is true knowledge.

But to say that the light is produced by gas is to refer to a judgment —not a direct perception. We do not perceive the gas. It is far away from us. We argue in our minds "what produces this light? Is it the sun? Is it the moon? Is it candles? Is it gas?" We consider, and balance the evidence, and conclude that the probability of its being gas far outweighs all other suggestions. A conviction or belief is the result. But this is not true knowledge, and it has nothing like the certainty of true knowledge.

We never can be sure that all possible evidence, upon any subject whatever, has come before us; nor that we have equally and impartially weighed all the evidence we had. How do we know, for instance, that the gas-company are not trying an experiment to-night, and using something which is *not* gas after all? We may have had the firmest belief that the light was produced by gas and yet find that we were wrong.

Every belief is open to contradiction, and liable to change. As long as a real belief exists at all it has the same force with us as if it were

knowledge, but it is essential to our progress to remember the clear distinction between them, and to keep the mind open and attentive to fresh evidence, because it may at any time bring us nearer to the absolute truth.

We *know* that we exist; that we feel pleasure and pain; that two and two make four; that the whole is greater than its parts; that there are such things as light and darkness, warmth and cold; that the rainbow is curved and coloured; that our cat has four legs, and our brother only two. These are all direct perceptions of truth, whether derived from the senses or from reason. But we only *believe* that we shall exist at any future time; that certain acts always produce pleasure and others always pain; that we could go to a grocer and buy a pound of sugar for fivepence; that the earth is spherical and revolves round the sun; that *every* cat has four legs, or every man only two. These are inferences, judgments, not perceptions, liable at any moment to be contradicted and proved false.

At present there is an immense amount of confusion in popular language, and even in scientific language, between propositions of these very different kinds. Almost any one would say in popular conversation, "Oh, you *know* that a cat has always four legs;" and few scientific writers would hesitate to say "we now know that the sun is about 92,000,000 of miles distant from the earth." Both statements are incorrect in calling that *knowledge* which is really *belief*. Probably a time will come in which greater precision of language will be demanded; when belief will be as clearly distinguished from knowledge as art now is from science.

Every student of science should cultivate such precision as one of his most precious instruments in the investigation of nature. For man's attempts to pick her locks are still supremely clumsy. He needs to make his keys a thousand times more delicate than any which he uses now before they will pass the wards of nature's inmost sanctuaries.

SOME NEW FEATURES IN THE GEOLOGY OF EAST NOTTINGHAM.

BY J. SHIPMAN, ESQ.

(Continued from page 20.)

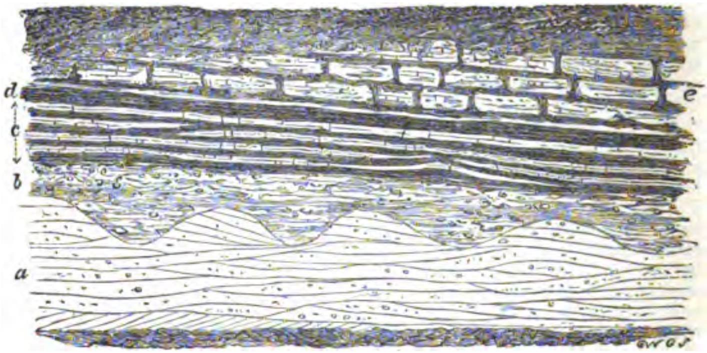
Not the least important respect wherein my map differs from the Government map is the much less area covered by Upper Keuper marl. The Geological Survey supposed that one effect of their two faults was to throw in between Lower Keuper a patch of Upper Keuper extending from Cranmer Street to Red Lane—that is, the space between the two faults. If their supposed curved fault had really existed I believe this would have been correct; but, as it is, the Upper Keuper, of which the Reservoir Hill consists, is cut off on the north side by No. 2 fault, and does not come in again till the ground rises to form Mapperley Hills. Then they mapped the Hunger Hills as being to a great extent composed of Upper Keuper. This is not so, however. The flat-topped appearance of these hills is caused, apparently, by a bed of sandstone, three or four feet thick, seen also in the cliff of Lower Keuper on Coppice New Road; and the Upper Keuper may be traced by the sudden rise of the ground,

its more rounded contour, and by its finely laminated character and bright red colour, as contrasted with the purplish and dull red of the highest beds of the Lower Keuper.

We come now to the most interesting feature of all that may be said to be new in the geology of this part of Nottingham. Running along the boundary line separating the Lower Keuper from the Bunter (f2) on the new map you will observe a narrow band coloured blue. That is the conglomerate forming the lowest bed of the Keuper in this district. It was seen at short intervals along the boundary all round the double tongue of Bunter in the St. Ann's Valley; and, although tolerably persistent, it is sometimes represented by a mere string of pebbles. The tracing of this conglomerate along the base of the Hunger Hills and round the opposite side of the valley to where it was cut off by No. 2 fault in Dame Agnes Street fairly did away with the theory of the curved fault; for, according to the Survey map, this valley ought to have been in Lower Keuper. The best exposures of this conglomerate were in Turner Street and on Hunger Hill Road, the section in Turner Street having the advantage of showing a perpendicular section, while on the Hunger Hill Road it had to be studied during the process of excavating. In Turner Street its greatest thickness was 22in., and it there consisted of rounded and partially rounded pebbles of all sizes up to boulders five or six inches long, consisting for the most part of quartz and quartzite, with a few bits of brown magnesian limestone, volcanic ash, basalt, greenstone, chert, slaty rock, and Coal Measure rock, the whole being firmly compacted together by lime and magnesia and oxide of iron, the latter giving it a strongly ferruginous aspect. Such is its compactness, indeed, that navvies who happen to have to excavate it have learnt to dread it, and affirm it to be the toughest rock they ever met with. It rested in the shallow cavities of an eroded surface of the Bunter, sloping to the east at an angle of about 5°, and was surmounted by first about 18in. of coarse mottled sandstone, then beds of finely-laminated brown and light olive-green sandstone, with thin partings of red marl. At its outcrop on the top of the low rounded hill of Bunter on Hunger Hill Road, the conglomerate, which, with its associated beds, formed a band at the surface about 50ft. broad, had much the same composition as in Turner Street, only there was more chert and a good deal of white limestone in lumps and ground-up, there being also calcite in minute crystals, and as a thick coating to some of the pebbles; it was about eight inches thick, and covered by first a thin bed of greenish grit, cemented into cakes by calcareous matter, then by an irregular series of beds about three feet thick, consisting chiefly of unconsolidated white (bleached) sand, false-bedded, and streaked with pale green and yellow, with occasional strings of pebbles enclosing lenticular beds of sand, of a ferruginous colour. The whole, though very irregularly bedded, had a general inclination to the north-east, passing under the Keuper. When a perpendicular section of these beds was exposed further under the Keuper, they presented a peculiar variegated wavy appearance, being streaked with red, yellow, and pale green. I was struck by the remarkable resemblance between these beds and the raised beaches I had seen on the sea shore, the only difference that I could perceive being the complete absence of any traces of life. Among the pebbles forming the conglomerate at this spot, I found what appears to have once formed the extremity of a sea-worn pinnacle of greenish fine-grained (Silurian ?) sandstone, such as may be seen at the present day along coasts where Silurian or Cambrian rocks are exposed. That this was its origin seems to me to be indicated by its peculiar water-worn aspect, and by the lateral grooves along the lines of stratification.

A very instructive section has lately been exposed in Ford Street,

nearly along the dip of the Keuper.* The conglomerate was here seen just before it crops out, occupying cavities in a gently sloping plane of the Bunter. The pebbles of the conglomerate blended with the overlying sandstone and marl, and the variegated beds swelled out slightly in the direction of the outcrop. The accompanying woodcut is from a sketch taken on the spot.



JUNCTION OF KEUPER AND UPPER BUNTER, FORD STREET, NOTTINGHAM.

e. Thick-bedded soft brown, yellow, and light green sandstone, with red and green finely-laminated marls (Lower Keuper.)
d. Ferruginous band (6in.)
c. Soft sandstone, streaked with green, red, and yellow.
b. Conglomerate, forming base of Lower Keuper (f5), filling eroded cavities in the Bunter (f2), 20in.
a. Bunter sandstone, yellow, "false-bedded," with a few pebbles.

In this section the Keuper *appears* to dip to the south, the true dip, however, being south-east.

The conglomerate was twice passed through in Dame Agnes Street during the excavations for the culvert, caused by a fault, as shown in section No. 1, and was there found to be divided into two strings of pebbles by a lenticular mass of coarse greenish-white sandstone about 4ft. thick. I met with a similar development of sandstone at the base of the Lower Keuper at the bottom of the new road through Patchitt's Park from the Reservoir to Red Lane, about 5ft. of unconsolidated yellow sandstone, streaked with red, and passing up into soft red marl, coming immediately above the conglomerate. The most easterly spot where I have seen the conglomerate is near the Westminster Abbey Inn, where the pebbles were embedded in a coarse red sand overlaid by greenish-gray marl. It has been met with as far east, however, as the first brickyard on Carlton Road, where it was penetrated after passing through 105ft. of Lower Keuper. The only localities where this conglomerate may now be seen to any advantage are in Calcutta Street, where the brown sandstone cropping out of the sloping ground from above the Bunter is studded as thickly as it will hold with pebbles, forming a band 22ft. across, with a thickness of about 3ft.; and in Red Lane, where it is seen encrusting the old surface of the Bunter. Although this section was carefully examined by Aveline, and described in his "Memoir on the

*This section has been opened out since the reading of the paper, and is, therefore, new; but it only bears out the views I had arrived at previously, and exemplifies, on a small scale, something of the character of the unconformity as shown by the more extensive and elaborate exposures of the junction now (Jan.) being made at Nottingham.

Nottingham District," (Sheet 71, N.E.,) he either did not observe this conglomerate at all, or mistook it to belong to the Bunter, for he mentions a less important conglomerate, about 16ft. higher up in the Keuper, but says nothing about the conglomerate at the bottom. This second conglomerate is well exposed in the section in Turner Street, also in the open ground at Belle Vue Terrace, at the top of Calcutta Street. Its maximum thickness is 12in., and it consists of small white and pink sub-angular quartz pebbles, flakes of fine red marl, pebbles of pink and white limestone, fine-grained light green sandstone, and bits of igneous rock embedded, in one spot in calcareous fine yellow sand, in another in calcareous greenish-white sandstone. Indeed, I found quartz pebbles distributed more or less throughout the lower beds of the Keuper sandstone along Blue Belle Hill.

With regard to the origin of the conglomerate forming the base of the Keuper, it is, of course, well not to attempt to draw conclusions in geology from too limited an area. There can be no doubt, however, that in this conglomerate, with its associated irregularly-stratified beds of sandstone, we have the remains of an ancient sea-beach—the shore of the sea in which the Keuper sandstone and clay were deposited. The pebbles composing the conglomerate are all such as may be seen in the underlying Bunter; the partially consolidated sandstone is easily recognised as Bunter sandstone that has been bleached, then re-deposited, and subsequently tinged with colouring matter. We know that the Bunter sandstone formed the land surface over a large part of England during what was probably a long interval, while the Muschelkalk of Germany was being deposited. Thus the conglomerate probably represents a great break in time in this part of England; and the fact that the plane of Bunter on which the conglomerate rests is inclined at a greater angle than the dip of the Bunter, as far as that dip can be ascertained, leads me to infer that *the old Bunter land was gradually submerged from an easterly direction*, during which the pebbles which probably more or less covered the land-surface came to be re-deposited and cemented with carbonate of lime and magnesia, and partially interstratified with bleached sand derived from the receding shore line.

FRESHWATER LIFE.—1. ENTOMOSTRACA.

BY EDWIN SMITH, ESQ., M.A.

[*Continued from page* 17.]

Passing to the second order, which is named *Copepoda*, we select for description the well-known *Cyclops quadricornis*. A lively female specimen, let us suppose, with egg-sacs attached, is, after repeated attempts with the dipping-tube, at length safely landed in the live-box. What is she like? We observe that the carapace is made up of many parts corresponding to the segments of the body. Four segments compose the thorax, the first, with which the head is consolidated, being very large. The abdomen counts six rings, and terminates in a forked tail. Standing out conspicuously from the head are two pairs of antennæ, each of the larger being made up of numerous joints, and all four armed with bristles. The mouth has a pair of strongly toothed mandibles, besides a first and second pair of foot-jaws, between which and the antennæ the breathing function appears to be divided. There are five pairs of feet, the four pairs useful for locomotion springing from the four divisions of the thorax. Each foot is itself double, and all are thickly furnished with

bristles. The first segment of the abdomen is small, and carries a fifth pair of feet, modified in both sexes to subserve the reproductive process. In the male the next two segments are distinct; in the female not. The larger antennæ of the male swell out about the middle, and make a hinge-joint behind the swelling, peculiarities wanting in those of the female. The adult female, in the breeding season, carries two external ovisacs, fastened one on each side, near the base of the abdomen. They must not be confounded with the true ovaries, which are internal. They are only a temporary shield, secreted by the female around each bundle of eggs at the time of laying them, and are ruptured and finally shaken off when the eggs are hatched. Lastly, one eye placed in the front of the head serves as the single organ of vision. It is often of a brilliant ruby colour, especially in young specimens.

As in most other genera so in this, the females are much more numerous than the males. The fact is no doubt connected with another peculiarity, which has been termed parthenogenesis. One impregnation enables a female Cyclops to go on laying successive batches of eggs for life. And the female progeny are themselves fertile, though carefully isolated as soon as born; and so on for several generations. The rate of increase of some species of Entomostraca is enormous. According to Jurine it is quite possible for a single female to be the progenitor during one year of many millions of young. But, practically, the rate of increase is checked by various aquatic enemies, the vast majority of the young being simply born to be eaten. There are few more interesting spectacles under the microscope than the hatching of a brood of Cyclops. When the time draws near the little things are seen all huddled together in a cluster, each in its separate pocket of the ovisac, peeping through the membranous veil with bright ruby-coloured eye. You single out one for special observation, and feel a growing interest as you watch the repeated struggles of the tiny prisoner, its final escape, and its first joys of liberty, as it darts away in the surrounding water, with the jerky, zigzag motion of its parent. Nor is it less interesting afterwards to note from day to day the changes of form and successive moultings by which the adult state is reached. Three moultings take place before the animal is perfect, and capable of producing its species.

Nearly related to Cyclops, and not much unlike it in appearance, is *Canthocamptus*, found abundantly in the ponds about Nottingham. As it is rather small, the best way to secure a specimen for examination is to place a portion of the gathering in a shallow dish, and look it well over with a pocket lens. A small dipping tube, made as follows, will be found useful:—One end must be drawn to a blunt point with moderate aperture, the other inserted into a short piece of india-rubber tubing, sealed air tight at the free extremity. The length of the glass part may be about two inches. Press the india-rubber between thumb and fore-finger, dip into the water, and by removing pressure at the right moment the object is sucked up into the tube, whence it may be expelled by once more pinching the india-rubber. The two commonest species of Canthocamptus are *C. minutus* and *C. furcatus*. In the female I have often found a curious reddish structure coming off from the sixth body segment. It is of a hard and horny nature, but its use is not known. Closely allied to the preceding is *Diaptomus castor*, easily recognised by its inferior antennæ, which are fully as long as the entire body. I have found it amongst algæ in stagnant drains.

Animals belonging to the first two orders of Entomostraca have comparatively few branchiæ, and these attached to the appendages of the mouth. Animals belonging to the remaining two orders have many branchiæ, and these attached to the legs, which are often numerous.

The latter are sometimes grouped together under the common designation of *Branchiopoda*, or the gill-footed division. To that division we now proceed.

To the third order, the *Cladocera*, belong the various species of Daphnia and its near relations. Let us first examine a full-grown Daphnia, preferably one of the larger species, say *D. pulex* or *D. vetula.* We see a body composed of two parts, the head terminating below in a sort of beak, and a thorax and abdomen, the two last enclosed in a nearly transparent carapace. In *D. pulex* the carapace tapers off behind in a long dagger-shaped point. In *D. mucronata* it bears two long spines at the posterior corners. In *D. vetula* it is lopped off bluntly and slantingly forwards. In *D. reticulata* it is marked with a network of lines over its surface; and in *Acroperus harpæ* these lines resemble the strings of a harp. Below the beak are a pair of exceedingly small antennæ, so small that they may be easily overlooked. Springing, as it were, from the neck, we see a pair of very large branched antennæ. These are the principal organs of locomotion. The eye consists of twenty crystalline lenses, or fewer, and is turned about on a cushion of appropriate tissue by two sets of muscles. This coarsely compound organ may be regarded as foreshadowing the highly perfect compound eye of insects. Just behind the eye may be seen the brain. At the junction of the head and body near the base of the beak, is situated the mouth, which opens into a short gullet, and that again into a roomy stomach with its two cæca; and then follows a straight intestine, which finally curves downwards towards the tail. Only the first segment of the body is adherent to the carapace, the rest moving quite freely between the valves. Ample room is thus afforded on the back of the animal for the accommodation of its eggs after they are laid; and there, accordingly, the eggs are carried about in a bundle till they are hatched. The tail, which terminates in two hooks, is used as a rudder and propeller. Its motions are very vigorous. If you look through the shell at that part of the body which succeeds the neck, you will notice an oval-shaped organ, which keeps regularly dilating and contracting. This is the heart. From its anterior extremity springs an artery, and on opposite sides of the heart are two slits which receive the blood from the surrounding cardiac chamber, and close up at each contraction while the blood is urged forwards. There are five pairs of legs, employed for other purposes than swimming. When the animal is at rest, they create currents in the water, and so bring food to the mouth. The first and second pairs are used as organs of prehension. The third and fourth pairs mainly subserve respiration, for which they are well adapted by their branchial plates fringed with numerous filaments. I have already remarked upon the extraordinary fecundity of many of the Entomostraca. The Daphniæ are no exceptions to the rule, and present similar phenomena of parthenogenesis. The development of the embryo may easily be watched through the thin carapace, and is, of course, extremely interesting. The first organ to show itself is the eye; on the fifth day from laying, the young Daphniæ come out, and then go through their series of moultings. One great advantage of the moulting process to the Entomostraca is, that they are thus able to rid themselves of troublesome infusorial parasites, which often lodge upon the carapace in great numbers, and seriously retard the movements and depress the vitality of their host. Bunches of *Epistylis* are very common upon Cyclops and Daphnia. Towards the approach of winter, the Daphniæ have the remarkable habit of enveloping eggs in a special casing between the outer and inner layer of the carapace. This casing, which is developed on the back of the mother, has been called the *ephippium*, from its fancied resemblance to a saddle. It will easily be recognised by the microscopist. When the skin is cast, this structure is

cast along with it; and, floating on the water, preserves the eggs through the cold season, till they are hatched by the returning warmth of spring.

In July, 1870, I found in a shallow pool on the turfy soil of Lindow Common, Cheshire, a good many examples of one of the Daphnia family, which, from its long bristles, bears the name of *Macrothrix*. My specimens corresponded to Baird's description, except that a particular bristle mentioned by him was wanting in my capture. I had possibly chanced upon a new variety. The superior antennæ are of considerable size, hanging from the beak like two flat swords, with a broad, straight-edged extremity. While watching an example in the live-box, what was my astonishment to observe some of the parts suddenly become double. One after the other, the hinder segment, its hooked spines, the beak, superior antennæ, and so on, appeared double; and it became evident that I was the fortunate witness of the moulting process. I at once mounted the whole affair in glycerine, and my Macrothrix now lies side by side with its cast-off skin.

One other family of the Cladocera should be mentioned, if only because it contains *Chydorus sphæricus*, a very common species in our stagnant ponds. The *Lynceidæ* (for so the family is called) may be recognised by a black spot situated in front of the eye, and looking not much unlike a second eye, which, however, it is not. The intestine, moreover, makes one complete turn and a half. To the same family belong *Eurycercus lamellatus* and *Acroperus harpæ*, both of which occur in this neighbourhood. The latter is fond of resting on the top of the water, moored by its antennæ to a bit of weed; or a cluster of them will collect round some floating leaf or sprig, and lie motionless in the warm sunshine as if asleep.

Of the last order, *Phyllopoda*, we shall cite only one example, *Cheirocephalus diaphanus*, or the Fairy Shrimp. I have not yet seen it alive, but those who have speak with enthusiasm of its singular beauty. The male is especially gorgeous. With regard to anatomy, the body is destitute of a carapace, and is divided into many segments, affording great freedom of movement. The male has a remarkable pair of inferior antennæ, employed essentially as clasping organs. Those of the female are simpler, being shaped like a broad sickle. There are two stalked eyes, each composed of an immense number of lenses, showing a further advance towards the insect type. Its young, however, has but one simple eye, placed centrally in front of the head. This is represented in the adult by a dark blind spot. No fewer than eleven segments compose the thorax, to each of which is attached a pair of branchial feet, of a broad and leaf-like form. The tail consists of two broad appendages; and both feet and tail are thickly beset with plumose hairs. Extending from the head to near the tail may be discerned about eighteen or nineteen small hearts, or quasi-hearts, placed end to end and all moving together. The female possesses a single external ovary, from which, at the proper time, from 100 to 400 eggs are jerked out in succession during twenty-four hours. When hatched the young undergo a series of moultings and changes of form before they finally resemble their parent.

We have now completed our illustrations of Freshwater Entomostraca. I shall not at present enter into any description of the marine kinds. Specimens of their empty carapaces, particularly of the Ostracoda, may be found in the sand of our coasts, and will often occur to the searcher after foraminifera. I have thus obtained examples of *Cythereis* and *Cythere*. I have also taken, near Penmaenmawr, a good many *Cetochilus*, a rather striking form resembling Cyclops.

The Entomostraca have played an important part in the life-history of the globe from the earliest epoch to the most recent. They have been

well represented through untold ages from Cambrian times to the present day. Their remains, especially of the Ostracoda and Phyllopoda, occur in all formations, and in some are so abundant as to give a peculiar foliated character to the rock containing them.

A few books of reference may not be unwelcome to the student. Before all the very complete manual of the British Entomostraca by Dr. Baird, published by the Ray Society; then the portions bearing upon the subject in Professor Huxley's "Anatomy of the Invertebrate Animals," and Professor Nicholson's "Zoology and Palæontology;" lastly, the splendid monographs on the fossils of the group by Professor Rupert Jones, the Rev. H. W. Crosskey, and others, published by the Palæontological Society. With such help, the systematic study of our old friends, the so-called water-fleas, will be found replete with interest.

THE CHLOROPHYLL-BODY AND ITS RELATION TO STARCH.

BY WILLIAM HINDS, ESQ., M.D., ETC., ETC.,
PROFESSOR OF BOTANY, QUEEN'S COLLEGE, BIRMINGHAM.

In the year 1865 I read a paper to the British Association for the Advancement of Science, an abstract of which was printed in their Transactions, to show the relation which existed between the chlorophyll-body and the starch granule. At the present time the views of some of the most eminent botanists of Germany appear to me to be, to a certain extent, approaching to the conclusions to which I have referred. What these conclusions are it is my purpose to show.

If we refer to the great English botanists of twenty years ago, we shall find them describing chlorophyll as a "vital secretion" *sui generis* or independent body.

One of our great authors of that period, who wrote on this subject, thus expresses himself in his Introduction to Botany* :—"Chlorophyll is a 'vital secretion,' and comprises 'coloured granules' of a 'spheroidal and irregular figure.' They 'consist of a semifluid, gelatinous substance, which seems to be a coagulum of the fluid contents of the cells.'"

Nägeli states that the parent cells of chlorophyll "are only half the size of starch, and that "they occur in company with starch grains."

In 1851 Mr. J. S. Quekett delivered, at the Royal College of Surgeons of England, a course of lectures on Histology, and on the subject of chlorophyll occurs the following:—"The green colour, so universally present in plants, is due to a more or less solid material contained in cells, and termed chlorophylle, or green vegetable wax." It consists of minute spherical or oval particles.

Dr. J. H. Balfour, in his Manual of Botany, 1860, page 11, states that "Chlorophylle, or the green colouring matter of plants, floats in the fluid of cells, accompanied by starch grains. It differs from starch in being confined to the superficial parenchyma, and in being principally associated with the phenomena of active vegetable life. It has a granular form, is soluble in alcohol, appears to be analogous to wax in its composition, and is developed under the agency of light."

* Lindley, fourth edition, page 138.

These quotations will serve to illustrate the confusion which existed formerly, and which even now exists in many minds as to the relation which the two bodies bear to each other.

In the paper to which I have alluded, I endeavoured to show, contrary to the then received view, that starch granules and chlorophyll bodies were really the same bodies, chlorophyll granules being merely and essentially starch granules pigmented, or coloured, on some part or parts of their surface, of a green colour, by the action of light; that it was a chemical product rather than a vital secretion, or not in a fuller sense than starch was; and that, if the starch granule were not a living entity, as is the protoplasm, whence and by which it is produced, neither was the so-called chlorophyll granule, inasmuch as the colour could be produced by light *without growth*, or without any indication whatever of vital action. As proof of this I exhibited then, as I have over and over again subsequently, potato tubers in which chlorisation or pigmentation had occurred, or a coating of green given to the surface of the peripheral starch granules, wherever exposed to light, and a certain temperature. This light need not be the sun's direct rays, but it must be accompanied with a certain temperature in order that the chemical process shall take place. This may be easily proved. Clean potato tubers may be placed on a table, and be exposed to the direct rays of the sun, in a room the temperature of which does not exceed 40° to 45° Fah., and, if examined in a week or more, it will be found that no chemical, or no appreciable chemical change has taken place, and no pigmentation or chlorisation has been effected. Repeat this experiment in a room with a temperature of 62° Fah., and in a week the surface exposed to light will have been densely chlorized, and without direct sun-light. Extend the exposure during a few more days, and the effect will be more intense. If, now, a small portion of the substance of this green peripheral matter be scraped off and mounted in water and examined by the microscope, it will be seen that in the short space of a few days the starch granules will have been converted into what are termed chlorophyll bodies or granules; but in reality showing, inferentially, that there is no such substance at all as a chlorophyll-granule as distinct from the starch grain. It may be added that, if exposed to light and a proper temperature, granules of starch are pigmented or chlorized more or less, so soon as they are secreted, or take on substance, as seen in leaves and other organs primarily exposed to light. Hence, uncoloured starches are known to inhabit the parts of plants excluded from light, as pith, rhizomes, subterranean stems, and fruits protected by bracts impenetrable to light.

I quote one short passage from the article alluded to, and must further refer the reader to the report itself.* "During several years of close examination of vegetable tissue, the author has found the attempt to divide these two substances (starch and chlorophyll) into two distinct bodies a source of perplexity; and, after a series of experiments and investigations, he arrived at the conclusion that these two series of granules must be considered fundamentally the same, one series being merely coloured or chlorized."

I shall now quote one or two short passages from the latest German authorities, to show views more or less approximative to those expressed by me in 1865, and that the tendencies of the most recent scientific opinion are certainly in this direction.

Sachs† states that "with extremely few exceptions, *grains of starch*‡

* Report of British Association, 1866, page 81.
† Julius Sachs, 1875 translation, page 46.
‡ The italics are my own.

arise in the homogeneous solid substance of the chlorophyll bodies." They are at first visible as points, gradually increase in size, and finally may so completely fill up the space of the chlorophyll grain that the green substance is represented only by a fine coating on the mature starch grain; even this coating may, under certain circumstances, disappear."

The history in brief of the chlorophyll body, and, allowing for variations, the result of varying conditions and circumstances, would seem to be that the starch granule is first separated from the protoplasm by the ordinary vital processes; and then, according to conditions and circumstances, either becomes pigmented and assumes the condition of chlorophyll, or else remains, as it does usually when excluded from light, an unpigmented granular body, and, growing by intussusception into the perfect, enveloped starch grain, with its ordinary physical characters of hilum and concentric markings, and having in this state its known and recognised chemical characteristics. This view receives some confirmation from the following passage from Rosanoff. * "The formation of the grains of the chlorophyll is not always contemporaneous with that of its colouring matter; they may be at first colourless, (as in *Vaucheria* and *Bryopsis*, according to Hofmeister,) or yellow (in the case of leaves of Monocotyledons or Dicotyledons imperfectly exposed to light or in the process of development,) and may afterwards become green."

Of course it must not be assumed by any means that no pigmented red, (Rhodospermeæ, &c.,) green, or yellow matter occurs except in the form of regular granules, for amylaceous products are known and acknowledged to be often amorphous. The acknowledged chlorophyll pigmented matters and particles too are also known to occur sometimes in "bands, stars, or irregular masses." In fact there is no limit to this informality, variation, or irregularity; moreover, light itself can be dispensed with in some cases. In Angiosperms light is understood to be essential to pigmentation or chlorisation, but fern-leaves and the cotyledons of Gymnosperms will become pigmented without light.

The conclusions which I first made known in 1866, and which I may here partly reproduce, were that the almost universal green of nature is essentially amylaceous, and can, therefore, supply fuel, at least in the matter of food, to animals. Though partly decolourised in dried grass, the same amylaceous principle is yet present. The nutritive properties of hay, which can of itself support animal life, can scarcely depend on the cellular tissue alone, and certainly not exclusively on the small proportion of nitrogen contained, nor on the fruits which, in the minor grasses, are insignificant. On the other hand, amylaceous matters are known to be intensely nutritive, as affording one main element of animal food, and not only so, but those parts of plants in which this proximate principle is concentrated are nutritive in proportion to the amount of that concentration.

THE RAINFALL OF 1877.

BY W. J. HARRISON, F.G.S.

Incomplete and imperfect as it must needs be from the early date of its publication, and from the fact that our staff of observers is as yet not fully organised, still the main features of the Rainfall of the past year in the Midland counties may be gathered from the table which we print below. In it the stations are grouped in counties, and the fall at a few other localities is given at the end for the purpose of comparison. For the

* See translation Sachs, page 49.

third year in succession the general rainfall over this district has been considerably above the average. Heavy rains in January, following similar downfalls in December of 1876, produced frequent floods. On January 3rd a steady and continuous downpour proved the maximum fall of the year in the eastern and east-central counties, and wet and cold weather continued to the end of April. May was also a cold month, but in June we had a remarkably fine and pleasant period, rainfall everywhere in England below the average, and falling on eight to ten days only. A heavy storm on July 14th (accompanied by electrical disturbances) caused the maximum fall in the western and west-central Midlands, over three inches falling in the twenty-four hours at Haughton Hall, Shifnal. August was wet, September about the average, but October was rather a fine month, followed, however, by frequent rains to the end of the year.

Station.	Observer.	Total fall. Inches.	Greatest fall in 24 hours. In.	Date.	Number of rainy days ·01 or more fell.
Norton-in-Hales, Salop......	Rev. Fred. Silver	39·59	1·65	July 14	132
Burford House, Tenbury....	Lord Northwick	28·69	—	—	—
Adderley Rectory, Salop	Rev. A. Corbet	38·52	2·82	July 14	219
Larden Hall, Much Wenlock	Miss F. Rouse Boughton	35 97	1·44	July 14	218
Leaton Vicarage, Shrewsbury	Rev. E. V. Pigott........	32·39	1·35	Sep. 2	214
Woolstaston, Salop	Rev. E. D. Carr..........	44·75	1·44	Aug. 15	232
Haughton Hall, Shifnal	Rev. J. Brooke	34·99	3·04	July 14	212
* Tenbury (Orleton)	T. H. Davis, Esq.........	33·35	0·92	July 14	225
St. John's, Worcester	G. B. Wetherall, Esq. ..	29·76	1·06	July 15	184
Tamworth	W. Arnold, Esq.	30·54	1·85	July 14	196
Alstonfield Vicarage	Rev. W. H. Purchas	48·48	2·23	July 14	191
Wolverhampton	Geo. J. C. Broom, Esq....	29·79	—	—	—
Burton-on-Trent............	C. U. Tripp, Esq.........	31·89	1·91	July 14	216
Coventry....................	J. Gulson, Esq..........	31·41	1·32	July 14	198
Bickenhill, near Birmingham	Rev. W. R. Capel........	32·54	1·37	July 14	204
Coundon	Col. Caldicott	32·11	1·28	July 14	205
Fernslope, Belper	J. G. Jackson, Esq......	38·08	2·21	July 14	231
Trent College, Derbyshire ..	C. U. Tripp, Esq.........	22·74	1·07	Jan. 3	184
Matlock Bath	R. Chadwick, Esq., jun.	46·52	1·80	July 15	195
Stony Middleton, Sheffield ..	Rev. U. Smith	46·79	2·98	Jan. 3	175
Hodsock Priory, Worksop ..	H. Mellish, Esq.	31·27	1·49	Sep. 2	208
* Mansfield.................	R. Tyrer, Esq.	34·83	1·51	Jan. 3	244
Nottingham	Meteorological Office....	29·94	—	—	—
Bruntingthorpe, Leicester ..	Rev. F. H. Bridges	28·72	—	—	—
Syston, Leicestershire	Jos. Hames, Esq.........	25·02	—	—	—
Leicester, Town Museum ..	W. J. Harrison, Esq.	25·94	0·87	April 9	197
Leicester, Belmont Villas ..	H. Billson, Esq.	25·80	0·87	April 9	197
Market Harborough	S. W. Cox, Esq..........	29·28	—	—	—
Coston, Melton Mowbray....	Rev. A. M. Rendell	28·68	—	—	—
Waltham....................	Mr. E. Ball	28·67	—	—	—
Harston (Grantham)........	F. Beasley, Esq.	29·12	—	—	—
Springfield, Peterborough ..	H. Whitwell, Esq.	21·67	—	—	—
Kettering	John Wallis, Esq.	27·41	—	—	—
Northampton, Sedgebrooke	C. Markham, Esq.	29·23	1·09	Jan. 3	210
Northampton	H. Terry, Esq.	27·05	1·03	Jan. 3	187
Castle Ashby, Northampton	R. G. Scriven, Esq.......	26·69	1·08	Jan. 3	198
Tickencote, Rutland	W. Hayes, Esq...........	24·61	1·47	Jan. 3	182
Oxford	Meteorological Office....	29·00	—	—	—
Cambridge	Meteorological Office....	26·47	—	—	—
Dover	Meteorological Office....	34·12	—	—	—
* Cirencester................	J. Bravender, Esq.	37·15	1·45	July 14	191
Yarmouth	Meteorological Office....	28·35	—	—	—
Louth	T. W. Wallis, Esq.	31·18	1·66	Sep. 2	—
Boston	W. H. Wheeler, Esq.	26·14	1·28	Jan. 3	194
York	Meteorological Office....	33·19	—	—	—
* Seathwaite, Borrowdale ..	Mr. T. Birkett	180·40	4·78	Sep. 12	244
Valentia, S.W. Ireland	Meteorological Office....	65·09	—	—	—
Altarnun Vicarage, Cornwall	C. U. Tripp, Esq.........	78·11	1·79	Aug. 26	236

* From Symons' Meteorological Magazine.

THE DISTRIBUTION OF THE GENUS *ROSA* IN WARWICKSHIRE.*

BY JAMES E. BAGNALL.

"Yon rose-buds in the morning dew,
How pure amang the leaves sae green."
Burns.

The beauty of the English wild rose is such that even the most unscientific wanderer through our country lanes instinctively gathers, examines, (doubtless superficially,) and naturally loves it. But a wild rose is a dog rose to the casual observer and nothing more. If I were to tell these non-botanical collectors into how many species, varieties, and forms, critical botanists have split up the genus, and that one of my greatest pleasures has been that of hunting up these forms, they would probably think me in a fair way for a lunatic asylum. Unattractive as such studies must naturally be to the uninitiated, to me they have a charm I cannot express, and I would any day cheerfully walk many miles to see a rare rose or a rare bramble.

When I first commenced the study of the family, I had only the fifth edition of Babington's Manual as a text book, which, excellent as it is in other points, scarcely seemed satisfactory in its treatment of this genus; hence it was that I hailed with pleasure the appearance of Mr. J. G. Baker's valuable monograph of the genus *Rosa*, published in Vol. XI. of the "Proceedings of the Linnean Society, 1869," (page 197.) Being thus provided with a good and complete guide, I recommenced the study of the roses of Warwickshire.

The sandy soils and neglected hedges of many parts of the county seem to favour both the growth and variability of the wild rose, and I soon found abundant materials for study. But before commencing to study this difficult genus in the field I obtained from the Rev. A. Bloxam a fairly complete fasciculus of the British roses, and during the winter of 1869-70 I carefully examined these, comparing each with the descriptions given in Mr. Baker's monograph. The knowledge thus obtained has served me much in my subsequent work. During the years that have since elapsed I have visited and collected specimens in nearly every available Warwickshire district, and the specimens collected have all been carefully compared with my type specimens and the descriptions in the monograph.

Many of the districts south of Warwick I have visited in company with my friend, Mr. H. Bromwich, an excellent botanist, who has paid special attention to this genus, and has worked with great success most of the country around Warwick. In the neighbourhood of Harboro Magna, near Rugby, I have had the company, guidance, and instruction of that learned and veteran botanist, the Rev. A. Bloxam, who is Rector of the village. In my notes I quote some of Mr. Bloxam's old stations, near Atherstone, a district worked by him in former days. The following list may, therefore, be considered as the result of the Rev. A. Bloxam's, Mr. H. Bromwich's, and my own observations, extending over many years. It is, I believe, a fairly complete list of the Warwickshire roses.

The nomenclature and classification adopted is that of Mr. Baker's monograph, in which he divides the genus into five primary groups, viz.: 1, SPINOSISSIMÆ; 2, VILLOSÆ; 3, RUBIGINOSÆ; 4, CANINÆ; and 5, SYSTYLÆ.

* Abstract of Paper read before "The Birmingham Natural History and Microscopical Society."

The Caninæ, which Mr. Baker considers to be only varieties of one species, are divided into three series, and each of these series into several varieties, by means of their fruit characters, the margination and clothing of their leaves, &c. My space is too limited to allow all these details to be noticed, and I can only refer the student who wishes to make a special study of the genus to Mr. Baker's excellent monograph, or to Dr. Hooker's "Student's Flora of the British Islands."

In all cases in which I have seen and collected specimens in the stations cited I have indicated it by this sign (†); where I only possess or have seen dried specimens, thus (‡). The initials A. B. and H. B. after a locality indicate that the plants have been found in those stations by the Rev. A. Bloxam or Mr. H. Bromwich, as the case may be; in all other cases the localities given are from my own note book.

Group 1.—Spinosissimæ.

Rosa Spinosissima, *(L.)* Local. Arrow, near Alcester †, Billesley †, Hazeler †, Oakley †, H. B., near Warwick.

Var. *b*, a form with aciculate fruit and peduncles is rare. Chesterton Wood ‡, H. B., Little Alne †.

R. involuta var. Sabini, *(Woods.)* Rare. Oakley ‡, H. B., Chesterton Wood ‡, H. B.

Var. Gracilis, *(Woods.)* A more robust form occurs, rarely, which Mr. Bromwich refers to this variety; to me it seems only a local form. Tachbrook †, H. B.

Var. Doniana, *(Woods.)* Rare. Woodloes †, H. B., near Warwick, lane from Hampton to Meriden †, near Allesley ‡, (T. Kirk.)

Group 2.—Villosæ.

R. Mollissima *(Willd.)* Rare. Grove Park †, near Hatton, Star Lane †, near Claverdon, lane from Solihull to Sharman's Cross †, Atherstone Road, near Over Whitacre †, Oakley †, H. B. The Warwickshire plant seems to be var. cærulea, (Woods.)

R. Tomentosa, *(Sm.)* A very variable plant, closely approaching the above through some of its varieties.

Var. *a*, Subglobosa, *(Smith.)* Seems to be a frequent form in the county. Sutton Park †, Anstey †, Packwood †, near Exhall †, Chesterton Wood, H. B. A very hairy glandular form occurs in Arrow Lane †, Tybourn Lane, near Umberslade †, Coleshill Heath †.

Var. Deseglisei, *(Bor.)* Mr. Bloxam's fasciculus from Rugby ‡, is a form with eglandular sepals, and leaves thinly hairy above. I find a similar form at Rowington † and Monkspath †.

Var. Cuspidata, *(Bieb.)* Bloxam's fasciculus, Atherstone ‡, is a form with small narrow acute leaves, with open compound serrations, and strongly glandular beneath. I also find it by Yarningal Common †.

Var. Scabriuscula, *(Smith.)* Tachbrook, H. B., ‡, Trickley Coppice †.

R. Sylvestris, *(Woods.)* Rare. Near Harboro Magna, A. B., ‡, Chesterton Wood, H. B., ‡.*

Group 3.—Rubiginosæ.

R. Rubiginosa *(L.)* Rare. Near Billesley, H. B., Bentley Heath †, Crackley Wood, H. B.

R. Micrantha, *(Smith.)* Local. Oakley †, H. B., Ladies' Wood, Ragley †, Whewporridge Lane †, near Shustoke †, lane from Coleshill Heath †, lane from Anstey to Arley Station †.

Var. Briggsii, *(Baker.)* A cultivated plant in the Churchyard at Harboro Magna †.

* Mr. T. R. Archer Briggs refers the plant from this station to *R. scabriuscula.*

R. Pulverulenta, *(M. Bieb.)* Rare. Field in Cathiron Lane, and by the railway crossing, both near Harboro Magna †, A. B.

Var. Billietii, *(Puget.)* Allesley ‡. Introduced here by Rev. Mr. Bree, from near Bidford.

Group 4.—Caninæ.

"Series 1, Eoristatæ. *Leaves* eglandular beneath. *Sepals* reflexed after the fall of the petals, deciduous before the fruit (which ripens late) changes colour."

*"Leaves glabrous on both surfaces. Peduncles not bristly."

R. Canina, *(L.)*

Var. 1, Lutetiana, *(Leman.)* A frequent variety. Marston Green †.

Var. 2, Surculosa, *(Woods.)* Rare. A more robust form, with numerous flowers in a cluster. Exhall †, Arrow Lane †, Marston Green †.

Var. 3, Sphærica, *(Gren.)* Rare. A form with leaves more rounded at base, and globose fruit. Dosthill †, near Moor Hall, near Sutton †.

Var. 4, Senticosa, *(Ach.)* Rare. Near Knowle Station †, Coleshill Heath †.

Var. 5, Dumalis, *(Bechst.)* A very frequent variety.

Var. 6, Biserrata, *(Merat.)* A more glandular form, with open very compound serrations, apparently rare. Exhall †, Harboro Magna †.

** "Leaves glabrous above, hairy on veins beneath. Peduncles not bristly."

Var. 7, Urbica, *(Leman.)* A frequent variety..Solihull †, &c. A small, neat-leaved form, with oblong, (not globose) fruit, occurs in lane from Stonebridge to Coleshill †. A form with glaucous leaves, wedge shaped at base, near Hampton † and near Langley †.

Var. Arvatica, *(Baker.)* Local. Lane out of Baker's Lane, near Knowle †, Hampton-in-Arden †, Curdworth Bridge †, Baulk Lane, Berkswell †, Drayton Bushes †, lane from Minworth to Water Orton †, Harboro Magna †, A. B., Rowington Green †. A small-leaved form in Sutton Park †.

*** "Leaflets more or less hairy on both surfaces. Peduncles not bristly."

Var. 10, Dumetorum, *(Thuill.)* Local. Near Middleton †, Haywoods †, Doe bank, near Sutton †, Hampton-in-Arden, near Patrick Bridge †, Baker Lane, near Knowle †, Marl Cliff, near Bidford †.

Var. 11, Pruinosa, *(Baker.)* A form with glaucous, doubly serrate leaves. Rare. Near Springfield House, Over Whitacre †.

Var. 12, Incana, *(Woods.)* A more pubescent, glandular form. Rare. Pinley, near Hatton †.

Var. 12a, Obtusifolia, *(Desv.,)* Local. Lane to Beausal Common †, Solihull †, Marstone Green †, Baulk Lane, Berkswell †, Bradnocks Marsh, near Hampton.

Var. 13, Tomentella, *(Leman)*, Local, but not rare. Near Solihull †, Hampton-in-Arden †, Atherstone †, Hartshill †, Kingswood †.

**** "Peduncles more or less bristly and glandular."

Var. 14, Andevagensis, *(Bast.)* Local, but wide spread. Pinley Green †, Lane at Myton †, Whewporridge Lane, Solihull †, Golden Cross Lane, Exhall †, near Castle Bromwich †.

Var. 15, Verticillacantha, *(Merat.)* Frequent. This form I have found in every district, Sohihull, &c.

A form having sepals glandular on the back is more rare. Cold Comfort, near Alcester †, and in lane from Stonebridge to Coleshill †.

A small, neat-leaved form, leaves like those of sepium, and sepals glandular on back occurs in Sutton Park † and near Shustoke †.

Var. 16, Collina, *(Jacq.)* Rare. Over Green, near Curdworth †.

Var. 17, Cæsia, *(Smith.)* Local. Whewporridge Lane, Solihull †, lane at Pinley †, Harboro Magna †, A. B., Over Green †, Water Orton †.

Var. 19, Decipiens, *(Dumort.)* Rare. Near Harboro Magna †, A. B., Doebank, near Sutton †. Neither of the Warwickshire forms have the glandular sepals of the type.

"Series 2, Subscristatæ. Leaves eglandular beneath. Sepals ascending after the fall of the petals, not deciduous till after the fruit (which ripens early) changes colour."

Var. 20, Reuteri, *(Godet.)* Rare. Near Shelly Farm † and in Lane to Sharman's Cross, both near Solihull †, near Mancetter.

Var. 21, Subscristata, *(Baker.)* Rare. Pinley, near Hatton † H. B., Hampton on the Hill †, Old Park, near Warwick, H. B., ‡.

Var. 24, Coriifolia, *(Fries.)* Rare. Over Green, near Curdworth †, Minworth †, Atherstone Road, near Nether Whitacre †.

Var. 25, Watsoni, *(Baker.)* Rare. Ashend, near Middleton †.

"Series 3, Subrubiginosæ. Leaves glandular beneath on the midrib and principal nerves only (not on the surface as in *R. rubiginosa*.)"

Var. 27, Borreri, *(Woods.)* Rare. Woodloes, near Warwick †, H. B., Baulk Lane, near Berkswell †.

Var. 26, Marginata, *(Wallroth.)* Rare. Meadows near Blythe Bridge †, and near Shelly Farm †, Solihull.

Group 5.—Systylæ.

R. Systyla, *(Bast.)* The typical plant has not yet been found in the county.

R. Gallicoides, *(Baker.)* Chesterton Wood, near Warwick †, H. B. A remarkable form, not recorded from any other British station.

R. Arvensis, *(L.)* Frequent. Marston Green †, Sutton, &c. †.

R. Bibracteata, *(Bast.)* Rare. Near Hatton Station †, Baulk Lane, Berkswell †, Chesterton Wood, H. B.

R. Setosa. Chesterton Wood †, H. B. A singular variety, approaching *Gallicoides*, *(Baker.)*

Review.

The Voyage of the "Challenger."—The Atlantic: A preliminary account of the general results of the exploring voyage of H.M.S. "Challenger," during the year 1873 and the early part of the year 1876. By Sir C. Wyville Thomson, Knt., LL.D., D.Sc., F.R.SS.L. & E., &c., Director of the Civilian Staff of the "Challenger" Exploring Expedition. 2 vols. Published by the authority of the Lords Commissioners of the Admiralty. London: Macmillan and Co. 1877. Price 45s.

These handsome, interesting, and instructive volumes are the latest contribution to the history of deep-sea investigation. They follow in natural sequence the author's former work, "The Depths of the Sea," which gave an account of the general results of the dredging cruises of the "Lightning" and "Porcupine," 1868-69-70, the scientific work of which was under the direction of Sir Wyville Thomson, Dr. Carpenter, and Mr. J. Gwyn Jeffreys. These volumes in like manner deal with the Atlantic portion of the more recent voyage of H.M.S. "Challenger."

It must be borne in mind that these two volumes are only a preliminary instalment of the authoritative account of the general results of the "Challenger" voyage, and that years may yet elapse before

the complete results can be published. From the address of Sir Joseph Hooker, at the recent anniversary of the Royal Society, we learn that the publication of the biological results of the Expedition have been arranged for by the Lords of the Treasury in communication with the Council of the Society, and the munificent sum of £25,000 placed at Sir Wyville Thomson's disposal for bringing them out with a completeness and in a form worthy of the expedition and the nation. Sir W. Thomson has, with the approval of the Council and the Government, chosen for his collaborators the ablest living specialists, and this irrespective of their nationality. Our own country has, with but few exceptions, supplied entirely competent and willing workers in most of the departments, while their association with such naturalists as Agassiz and Hæckel cannot fail to be gratifying to themselves and assuring to the public.

The primary object of the expedition was, as our readers are aware, to explore the conditions of the deep sea, and the staff consequently took every possible opportunity of making deep-sea observations, and in these volumes the results achieved are recorded with such care and exactitude as to make them most valuable and instructive to men of science, and yet so pleasingly and with so much that may be described as of a popular character, as to make the volumes available for, and enjoyable by, those who read mainly for pleasure. The dredgings were made in the greatest depths, and also from time to time in shallow water in the most remote regions, and thus many undescribed animal forms were acquired; collections of land animals and plants were likewise made on every available occasion, and consequently naturalists of all kinds will find in these pages matter of interest to them.

From the time when the "Challenger" left Sheerness, on December 7th, 1872, to her arrival at Spithead on 24th May, 1876, she traversed a distance of 68,890 nautical miles, and at intervals about 120 miles apart 362 observing stations, of which nearly 200 were in the Atlantic, were established. The observations made at each of these were, as far as circumstances would admit, the following, after the position of the station had been ascertained:—1.—The exact depth was determined. 2.—A sample of the bottom, averaging from 1oz. to 1lb. in weight, was obtained. 3.—A sample of the bottom water was secured for physical and chemical examination. 4.—The temperature was determined. 5.—Generally a fair sample of the bottom fauna was obtained by dredge or trawl. 6.—The fauna of the surface, and of intermediate depths, was examined by the use of the tow net. 7.—A series of temperature observations were made at different depths from the surface to the bottom. 8.—Samples of sea water were obtained from different depths. 9.—Atmospheric and other meteorological conditions were carefully observed and noted. 10.—The direction and rate of the surface current was determined. 11.—At a few stations an attempt was made to ascertain the direction and rate of movement of water at different depths.

Of the many points on which the expedition has thrown light, we can only select a few for this notice. Many of our readers will, no doubt, recall the discussions which have taken place as to the origin of the portion of sea-bottom covered with what is known as "globigerina-ooze," or "modern chalk," which consists usually of a creamy surface layer, made up of little else than the shells, most of them almost entire, of *Globigerina*, *Pulvinulina*, and *Orbulina*, with a relatively small proportion of finely divided matter, consisting chiefly of coccoliths and rhabdoliths, and a still smaller proportion of the spines and tests of radiolarians and fragments of the spicules of sponges, &c. Below this layer occurs another, an inch or two in thickness, somewhat more firm in consistence, in which most of the shells of all kinds are more or less broken up, and their

fragments cemented together by a calcareous paste, the result of the complete disintegration of many of them, and beneath this a nearly uniform calcareous paste, coloured grey by decomposed organic matter, and containing whole and fragmentary shells only sparsely scattered through it (pp. 206-7, vol. I.) Mr. Murray, one of the naturalists of the expedition, paid great attention to the question of the origin of this calcareous formation. Very early in the voyage he formed the opinion that all the organisms entering into its composition at the bottom are dead, and that all of them live abundantly at the surface and at intermediate depths over the globigerina-ooze area, the ooze being formed by the subsiding of these shells to the bottom after death (p. 208, vol. I.) This, although not a new view, was a disputed one, Dr. Carpenter and Sir Wyville Thomson being formerly among those who thought that the evidence was conclusive that the foraminifera which formed the globigerina-ooze lived on the bottom. Sir Wyville (p. 210, vol. I.) now acknowledges that he was mistaken, and he is of opinion that it may "be taken as proved that all the materials of such deposits (with the exception, of course, of the remains of animals, which we now know to live at the bottom at all depths, and which occur in the deposit as foreign bodies) are derived from the surface." "Mr. Murray finds the closest relation to exist between the surface fauna of any particular locality and the deposit which is taking place at the bottom."

The voyage has made known to us a number of new and beautiful forms of Sponges. One of these, *Euplectella suberea*, a beautiful and singular addition to these forms of European fauna, is figured at page 139, vol. I. It belongs to a very special group of sponges called the Hexactinellidæ, because the siliceous spicules throughout the family appear to be six-rayed. It is an old family abounding in many graceful shapes in the beds of chalk and greensand of the south of England, but until lately the fossil "ventriculites" were supposed to be extinct, and the discovery of their descendants living in the modern chalk beds of the Atlantic was one of the most interesting of the many corroborative evidences in favour of the view of the "continuity of the chalk."

The expedition has much enlarged our knowledge of deep sea fauna. It has introduced us not only to new sponge forms but to numbers of new crustaceans, corals, sea urchins, star fishes, bryozoa, and fishes. The observations on the "Gulf-stream" and the fauna of the "gulf weed" (*Sargassum bacciferum*) are particularly interesting.

During such a protracted voyage opportunities for landing on shore were always gladly made use of, and some of the descriptions of what was seen on these occasions will, we have no doubt, be among the most attractive portions of the narrative to general readers. We may point out the description of the Bermudas Islands, and the formation and characteristic peculiarities of coral reefs as a good specimen of Sir Wyville's descriptive powers. The geology of the Bermudas is sketched slightly, but with much precision. Some curious particulars are given of a "Sand-glacier" at Elbow Bay, on the southern shore of the main island. The sand has entirely filled up a valley, and is steadily progressing inland in a mass five and twenty feet thick. It is covering up cottages, and has overwhelmed a cedar wood. The only way of stopping it artificially, says our author, is to cover it with vegetation. If planted in large numbers and tended and watered for a time it seems that oleanders and the native juniper will grow in the pure sand, and if they once take root the motion of the sand ceases. Some native plants, which form a peculiar vegetation, sending out enormously long runners or roots—such as *Ipomæa pes-capræ* and *Coccoloba uvifera*, and the crabgrass *Agrostis virginica*—then take hold of it and it becomes permanently fixed. The outer aspect of the sandhill of course slopes downwards towards the sea, and whenever

its progress landward—its growth—has been arrested the tendency of the incoherent mass is to travel back again by gravitation and the action of rain; accordingly it is not unusual to be told that one of these *coulées* is gradually disappearing.

Among the more original and striking results of the expedition is the conclusive proof that "the conditions of the bottom of the sea to all depths are not only such as to admit of the existence of animal life, but are such as to allow of the unlimited extension of the distribution of animals high in the zoological series, and closely in relation with the characteristic faunæ of shallower zones" (page 203, vol. I.) Our readers will scarcely need reminding that until within recent years the general belief was that beyond a certain very moderate depth in the ocean, organic life entirely ceased, and all was death and darkness.

Fig. 3.

The two volumes are illustrated by nearly 300 woodcuts of first-rate excellence, many of them we feel inclined to think unsurpassable. By the courtesy of Messrs. Macmillan and Co. we are enabled to

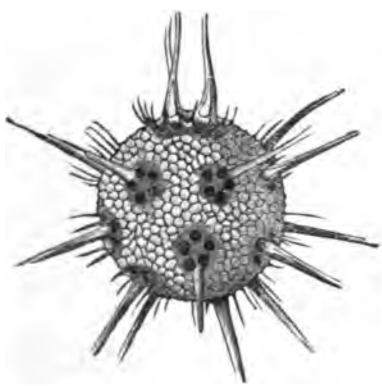


Fig. 4.

Fig. 5.

present our readers with three specimens of them. They are all forms of the new order "Challengerida," "the only new group," says Sir Wyville Thomson, "of higher than generic value which has come to light during the Challenger Expedition." Figure 3 represents the type genus *Challengeria*, magnified 400 times. Figures 4 and 5 represent forms of the Challengerida. This order has apparently hitherto escaped observation. These forms are extremely minute, although some of them are nearly the size of the smaller Radiolarians, which they approach in certain features. About thirty species have been met with during the Challenger Expedition. There are numbers of charts, showing the routes and observing stations, tables of temperature and other meteorological information, a contour map of the Atlantic, and an exquisite vignette portrait of Sir Wyville Thomson, engraved by Mr. C. H. Jeens. Author, Artists, and Publishers are to be congratulated on the results of their several labours, and we venture to think that the volumes will attain a deservedly wide and enduring popularity.

E. W. B.

History of the Societies in our Union.

I.

THE DUDLEY AND MIDLAND GEOLOGICAL AND SCIENTIFIC SOCIETY AND FIELD CLUB.

The Society under its present name was established in 1862, but for twenty years previously a somewhat similar one, called the Dudley and Midland Geological Society, had been in existence.

When the Society took its present form Geological investigation was receiving much attention all over the country, and it was natural that its practical application should be recognised as of the greatest importance to a district so geologically interesting and mineralogically important as the South Staffordshire. Upwards of 500 members were soon drawn together, many of whom received at the early meetings those first impressions of the Sciences, and the impetus to enter on their study with earnestness, which has since yielded valuable results to themselves and others. Mr. John Jones—afterwards of Middlesborough—was the first Honorary Secretary, and rendered the Society most important help.

In 1865 the British Association visited Birmingham, and the Dudley Society, by their valuable aid, greatly added to the interest of the meeting.

In 1866 there was a notable Exhibition at Dudley, which afforded great pleasure and varied instruction to large numbers of visitors. The Earl of Dudley lent his pictures by old masters, and there were good and carefully selected collections of specimens of local arts and manufactures. A handsome profit remained, after the payment of expenses, which was devoted to the purchase of Fossils for the Museum. During this period, the members of the Society occupied much time in conducting the scientific Clubs, attracted by the Exhibition to Dudley, to the many places of geological interest in the neighbourhood, and were so much engaged in this way that little time was left for the ordinary work of reading papers and discussion.

In 1867, a Mine Agents' Association, which afterwards became the South Staffordshire and East Worcestershire Institute of Mining Engineers, originated out of the desire of many of the members of this Society to have frequent opportunities of visiting collieries and works, and to see the practical application of scientific knowledge. Similarly, in 1869, a somewhat kindred organisation grew into existence at Wolverhampton—the South Midland Institute of Civil, Mining, and Mechanical Engineers. Between both these bodies and the older Society, out of which they may be said to have grown, the most friendly feeling has always existed.

A brief but interesting record of the proceedings of the Society is published annually. Two volumes and four parts of the third volume, 1862-1876, have at present been issued, and others are to follow. The Society possesses a Museum very rich in fossils and other Geological specimens, and a good library of scientific books.

During the summer months numerous Field Meetings are held, and increasing interest is manifested in them. They are arranged so as to embrace not only places of Geological interest, but also ruins, interesting churches, and other buildings, places of historical celebrity or natural beauty; and also afford opportunities for the collection of botanical, entomological, and microscopical specimens. Occasionally during the

winter months papers are read and discussed at the periodical meetings of the members held at Dudley.

The Society now numbers 14 honorary members, together with the Presidents and Secretaries of the various other societies in the neighbourhood, and 158 ordinary members. The subscription is 10s. 6d. annually. The funds are in a flourishing condition.

For the first two years the President was Lord Lyttelton. From 1864 to 1870 the Earl of Dudley was President; and since that time the Presidents have been:—Professor Ramsay, 1871; E. F. Smith, Esq., 1872; Rev. J. H. Thompson, 1873; William Madeley, Esq., 1874; Charles Cochrane, Esq., 1875, 1876, and 1877.

Mr. John Jones was Honorary Secretary for six years; Mr. W. Madeley, for five years; in 1873, Mr. E. Terry; and since 1874, Mr. E. B. Marten, Pedmore, near Stourbridge.

The practical benefits which have flowed from this Society are thoroughly realised and valued throughout the South Staffordshire Mining District, and its beneficial influence is felt over a still wider area.

Correspondence.

Black-backed Gull.—A fine specimen of the black-backed gull was shot at Allesley, near Coventry, in December last, having doubtless been driven inland by a storm. Its plumage was a dull white, mottled with greyish brown, and no black about it except the bill. This shows that it was an immature specimen, as it acquires the black back from which it derives its name at the age of four years.—John Gulson.

Water-fowl.—With the advent of winter various water-fowl have again visited, for brief periods, the larger sheets of water around Birmingham. At the Edgbaston Reservoir, Mr. Wyatt informed me that several Herons (*Ardea cinerea*, L.) have been seen within the last few weeks; as also a fine flight (forty-six) of a duck which I presume to be *Mareca Penelope*, L. During December, Mr. Dixon, of the Lower Grounds, Aston, records the arrival, on the pools of that place, of several Little Grebe, (*Podiceps minor*, Lth.,) as many as four being observed at one time. —A.M.B.

Mildness of the Season.—On Christmas Day last, I gathered in my garden, at Moseley, Worcestershire, (500 feet above sea level, subsoil gravel,) a very respectable out-door posy, consisting of several sorts of chrysanthemums, three kinds of roses, mignonette, pansies, violets, primroses, polyanthuses, clematises, Christmas roses, (*Helleborus niger*,) yellow jasmine, wall flowers, and ten-week stocks. I do not remember ever before gathering so many tender flowers in a situation so exposed, so late in the year.—E. W. B.

Mounting.—There is one question to which I have tried in vain to get an answer, but which may, perhaps, meet with a reply, through your pages. Some years ago, I believe, the accomplished microscopists of the Birmingham Natural History Society gave a series of lessons on mounting of various kinds to the younger members. In these I was not privileged to share. My question is, would not a second series be useful now? There must be many fresh members, and among them some, like

myself, who would be glad of a little help in this portion of their studies; a help which there are many well qualified to give, who would, I doubt not, be glad to give it, when they know that the desire for it exists.—Neo-Microscopicus.

Conchology.—During a geological excursion of the Natural Science Section of the Nottingham Literary and Philosophical Society, I found *Helix cantiana*, together with *Helix ericetorum*, on the sides of a railway cutting, in the Great Oolite Limestone, at Kingscliffe, Northamptonshire. The cutting is on the new line being made between Melton Mowbray and Kettering. I do not know whether it has been noticed in that neighbourhood before.—At Easter, 1876, I found (during a walk from North Rode, Cheshire, across the hills to Buxton) some dozen or more specimens of *Limnæa truncatula*, in a pond. They were, as far as I could see, its only living occupants. The sides and bottom of the pond were coated with a yellowish rusty matter, which looked like oxide of iron. I thought the fact rather remarkable. During the early part of 1877 I found just the same thing occurring in a pond by the road side, about a mile out of Mansfield on the way to Edwinstowe. But in this case, there was no rusty deposit. Again, close to Nottingham, this same mollusk occurs in a ditch, along with *Physa hypnorum* (plentiful) and a small *Pisidium*, and very rarely indeed *Limnæa peregra* (the spire of the latter being much elongated, and finely tapered, and the body whorl of the shell smaller than is usual.) Is it customary to find this mollusk (*Limnæa truncatula*) unassociated with any other species? Perhaps some of your readers could inform me. In none of the cases was it plentiful.—C. T. M., Nottingham.

Volvox Globator.—On a hill, near Redditch, are two ponds, some 300 yards apart, the overflow of the upper of which runs into the lower. On Christmas-day, 1875, *Volvox globator* was found in extraordinary profusion in the lower pond, where it continued in abundance during the following January, but soon after disappeared. In the upper pond, though at no time so numerous, specimens were found as late as March. Search was made for them frequently during the remainder of the year without success. As it appeared to the writer remarkable that they should occur in such numbers in the winter, he was induced to examine both ponds on Christmas-day, 1876, and on several occasions during January and February, 1877, but not a *Volvox* was visible. Nor did any put in an appearance till July, when they were observed in the upper pond only, though subsequently they were sparingly met with in the lower. Incessant rain during the winter months had made the water very turbid, and possibly this state of things did not favour their development. On the 6th January, 1878, *Volvox* was again found in considerable numbers, though not in profusion, in the upper pond, nearly all the specimens being young. They continue to flourish, and with them occur abundance of that beautiful rotifer *Conochilus volvox*, which has been constant in that pond throughout the year.—S. S. R., Redditch.

London Notes by an Occasional Correspondent.—Such of us, and we were a larger audience than usual, as attended the meeting of the Linnean Society, on January 17th, had a great treat in hearing and seeing Professor Owen and Dr. Darwin, both, in consequence of feeble health and advancing years, being very rare visitors on one evening to the learned societies. The Professor's paper on a missing link (just found) between the existing Marsupials and some early forms of (now) fossil life, was of great importance, but too technical for its scope to be indicated in a paragraph. Mr. Francis Darwin, a most worthy follower in the steps of his great father, read a paper on the results of feeding *Drosera rotundifolia*, which sets at rest the question of digestion and absorption in plants. After

quoting *inter alia* the researches of Mr. Lawson Tait, he told us he had filled six soup plates with moss in water, and planted them last June with as many plants of Drosera as they would hold. Each plate was then superficially equally divided by a piece of wood, (a slip of zinc in a previous experiment having killed the plants,) and the whole of the plates were exposed to precisely similar conditions as to light and air, and covered with the (now historical) gauze frame to prevent the access of insects. In July Mr. Darwin commenced and continued to feed all the plants on one side of each plate with roast beef, (*raw* meat kills,) in morsels weighing only 1-50th of a grain, taking great care none should fall into the surrounding moss and serve as manure. *This* is the result, and its accuracy is unquestioned :—The fed plants were individually and collectively larger, heavier, and greener, they threw up more flower stems which bore each a larger number of flowers, and a greater number of larger seeds, the proportion in weight of the seeds on the starved as compared with the fed side being as 100 to 379·7. Dr. Masters remarked that there could *now* be no doubt as to the absorption through leaves, and that the whole present theory of plant growth, involving largely the entire system of vegetable physiology, must be reconsidered, probably entirely changed. There was no attempt to contradict Mr. Darwin's facts, which are accepted by some of the greatest naturalists in the world, and another great era in change is imminent.—Dr. Darwin is so like M. Rajon's etching of Mr. Ouless' portrait, that I heartily commend that grandest of the etchings of this century to your readers.—The loss of Mr. Andrew Murray, the Entomologist, is much greater than will be at once seen. His services to the Horticultural Society, and to the entomological collection at Bethnal Green are incalculable, and as an acquaintance or friend all who knew him deeply deplore him. He told me only a month ago that his second volume on Economic Entomology was in the press; but who will complete the series I do not know.—W. J. S.

On Accuracy in the Use of Scientific Terms.—I have read with considerable interest the first article in your (may I say *our)* new Journal, on "Abnormal Ferns." The importance and value of this contribution, as an incentive to the practical study of vegetable development, has induced me to offer a few friendly remarks on one point, which the *composition* of this article suggests. It is this: Assuming that the "Midland Naturalist" is intended to have a direct bearing on the progress of Science, all the articles it contains should be written, not *merely* in an attractive style—which should always be aimed at—but with rigid scientific accuracy as to the *terms* employed by its contributors. Confusion in terms leads to confusion of thought; and *vice versa.* The employment of entomological and other zoological terms—having a very specific meaning—to describe, or illustrate, simple botanical processes of growth, for which there are true botanical terms, equally expressive and far more accurate, appears very likely to mislead a young enquiring naturalist. Now, these remarks have been suggested by a few illustrations, used by the author of the paper referred to, in his otherwise very valuable and instructive article. In speaking of the fertilisation of ferns, certain "spiral filaments" are described as having "*swarmed* about the pistillidium in numbers," as though they were a collection of independent individuals, clustering together like a swarm of bees! Again, in the next paragraph, these filaments are spoken of as being "tossed into the air," and by landing in certain "cups" are said to "fertilize the plant in its *caterpillar stage*, and thus enable it to put on its *butterfly life* or fronds." Now the phrase "caterpillar stage," suggests one of the most *definite* and *peculiar* stages of insect development. So peculiarly *animal;* so utterly unlike anything to be found in the vegetable king-

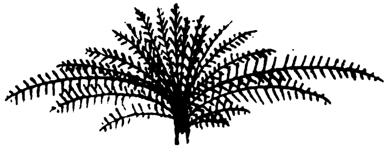
dom is it, that its use in such a connection as that referred to must be misleading to any reader not thoroughly acquainted with the subject. The "caterpillar stage" in an insect's life is that in which the entire body is almost filled with a capacious stomach; and the creature—endowed with a voracious appetite—eats, and eats with a greedy persistence, until its skin becomes too tight for the rapidly growing body, and at length splits, and is cast aside—like a schoolboy's "old clo"—to be replaced by a more roomy investment! The caterpillar stage, moreover, is one in which *no reproductive* organs appear; so that, altogether, the simile is a most unfortunate one as descriptive of the silent and gentle changes which are everywhere observable in the vegetable world. Once more, the term "Animalcules," as quoted by Mr. Lowe from Count Suminski's paper, and applied to these "spiral thread-like bodies" is equally inappropriate. I regret very much having to make the foregoing criticisms, and beg to assure the Editors, and the justly well-known author of the paper referred to, that my only object in doing so is to further the best interests of our new publication by requesting at the outset, from future contributors, a more careful selection of terms used in all scientific papers.—SAMUEL H. PARKES, King's Norton.

A HYBRID FERN.—Mr. Lowe, in his paper upon "Abnormal Ferns," says that "*very rarely* a hybrid species may be produced" by the crossing of two species; but the examples he gives relate in each case to species of the same genus. In Phanerogamous plants hybrids between closely allied genera are known to exist, and we might expect that this would also be the case with Ferns. I have lately met with an instance in which this hybridisation seems to have taken place. About two years ago, my brother, Mr. T. B. Grove, of Eastbourne, sowed a mixture of spores of *Blechnum corcovadense*, and *Lomaria gibba*. Both of the plants from which the spores were taken were well grown, with stems about three feet high. Two fronds made their appearance from this sowing in advance of the rest, and were carefully transplanted. The other seedlings were normal, but these two, after throwing up at first fronds very similar to those of *L. gibba*, gradually changed their character. The pinnæ increased in breadth, the fronds became longer and more erect, and they have now produced fertile fronds intermediate between those of the two supposed parents. The differences may be thus enumerated: I am of course describing average plants. *L. gibba* has a *spreading* crown of *numerous* barren fronds, the pinnæ of which are under half an inch broad, with a few small *blunt* teeth. The fertile fronds, springing from the centre, are very much *contracted*, of a light green colour at first, covered on the under side almost *completely* by the sori. *B. corcovadense* has a much *smaller number* of barren fronds, which are nearly *erect*, and considerably longer, and have the pinnæ more than three-quarters of an inch broad, with a *spinulose*-serrate, or almost dentate edge. The fertile fronds are fewer and longer still, of a pinkish colour at first, quite *uncontracted*, the pinnæ being as broad as those of a barren frond, and the sori only occupying the *central* line. The supposed hybrid has a few external fronds small and *spreading*, with narrow pinnæ, very like those of *L. gibba*, but the succeeding fronds become longer and more *erect*, with pinnæ over half an inch broad, and a serration which is intermediate between *blunt* and *spinulose*. The fertile fronds are more numerous than in *B. corcovadense*, not so long, and *rather contracted*, the pinnæ being scarcely over half the breadth of those of the barren fronds, and the sori occupying about *half* of the under surface. The colour of the young fronds also is intermediate between the pink of *Blechnum* and the lively green of *Lomaria*. I have before me three fronds of about the same age, from plants grown under similar circumstances.

Plate A.

Produced by A. Pumphrey's Patent Autographic Process.

To face Page 52.



Lomaria gibba.

Lomaria hybrida (?)

Blechnum corcovadense.

Outline Sketch of Ferns.

The frond of *L. gibba* is eleven inches long, and four broad; of the hybrid thirteen inches long, and five broad; and of *B. corcovadense* twenty-six inches long and seven broad. The spores of the hybrid are smaller and more irregular in shape than those of *B. corcovadense:* some of them have been sown, and are now in the prothallus stage. A well known fern-grower, who has seen the plants, said that he obtained a very similar hybrid, about six years ago, between *L. gibba* and *B. brasiliense*, (a species allied to, if not identical with, *B. corcovadense*,) which he exhibited at a meeting of the Royal Horticultural Society under the name of *L. hybrida*. He has since lost it. The correctness of his explanation was, of course, disputed at the time, but this independent production of what is nearly the same species seems to confirm it very strongly.—W. B. GROVE, B.A.

Gleanings.

THE BRITISH ASSOCIATION.—It is expected that the meeting for 1879 will be held at Sheffield.

A COURSE OF INSTRUCTION IN ZOOTOMY by Professor Huxley, assisted by Mr. T. J. Parker, is announced as in preparation, and will be published in parts, by Messrs. Macmillan and Co.

THE GREAT METEOR OF NOV. 23RD.—Capt. G. L. Tupman has been investigating the path of this remarkable object. In *Symons' Meteorological Magazine* for January, he writes:—"I have made out its path very satisfactorily from a great many fairly accordant observations. It began as an ordinary shooting star, ninety (nautical) miles high, five miles north of Derby, became wonderfully brilliant fifty miles over Liverpool, and burst at the height of twenty-six miles, fifteen miles N.N.W. of Great Orme's Head. From no less than twenty-five estimations of its duration, the velocity was between eighteen and nineteen miles per second."

THE "TIMES" AND METEOROLOGY.—The energy of the *Times* in publishing daily a map showing the principal elements of the weather at six P.M. on the preceding evening was specially noticed in the evidence given before the Royal Commission on Meteorological Observations, whose report (Blue Book, 1877, price 2s. 4d.) should be studied by all who are interested in the progress of meteorology. The publication now before us (The *Times*' Register of Events in 1877) is another step in the same direction. One page is given to each day. In a narrow column on the right-hand side we have the leading British and Foreign events printed in bold capitals. On the left-hand is a map showing the condition of the weather over these islands at eight A.M., together with the "Remarks" of the Meteorological Office thereon. At the end of each week the curves of the self-registering instruments at Kew Observatory are given. Useful and full summaries of the Parliamentary Session and the year generally are given at the end of the volume. We would suggest that another year the publication should be deferred (if necessary) for another week or so, that the averages and totals for the year (barometric pressure, temperature, rainfall, &c.) might be added.

ILFORD FOSSILS.—The very fine collection formed by the late Dr. Richard Payne Cotton, F.G.S., has, we learn from *Nature*, been

bequeathed to the Museum of Practical Geology, London. It contains 246 specimens of vertebrate remains. A very perfect lower jaw of the beaver (*Castor Europæus*), with some well preserved bones of the *Elephas primigenius*, the *Rhinoceros leptorhinus*, and the *Bos primigenius*, are among the gems of this valuable collection.

Geology.—An interesting boring for coal is now going on close to the eastern suburbs of the town of Leicester. In 1876 a bore-hole at this spot reached a depth of 750ft., entirely in the Keuper marls and sandstones, but stopped at this point in consequence of the boring rods breaking and stopping up the hole. The Diamond Rock Boring Company have now contracted to go down to a depth of 1,200ft., but, in our opinion, the question will be settled at a less depth than this. The proximity of the ridge of Palæozoic Rocks, which runs southwards from Charnwood Forest by Enderby, Sapcote, &c., is an important factor in the question. Desford marks its western edge, so that if the ridge, or the rocks (inferior to the coal-measures) which rest upon it, extends eastwards beneath the Trias for eight miles, it will be an effectual bar to the finding of workable coal-seams in this locality.

Aquaria.—Mr. W. A. Lloyd, of the Crystal Palace Aquarium, is engaged in writing a practical book on Aquaria, for which he has long been collecting materials. Writing on the subject, he says:—"My illustrations will be numerous, original, and unusual, consisting mainly of views, plans, and sections of many aquaria, and of the various kinds of machinery employed in them to circulate the water, and will include also all the portraits I can find of those who did early and good aquarium work. Among these I should like to have a portrait of Mrs. Anne Thynne, who, in London, in the year 1846, maintained the earliest known marine aquarium on the compensating principle, with plants and animals balancing each other. Any hints or references to early books, or pamphlets, or prints, or pictures, or photographs, will be very acceptable. Among other things, I much want access, temporary or otherwise, to two aquarium guide books to two now non-existing aquaria, one in Vienna, dated about 1860, and one in Copenhagen, about 1873-74. I shall be very grateful for any properly-authenticated details in MS., or any references to such as have been published, on the maintenance of any animals, ranging from sponges to fishes, both marine and fresh water, under the conditions proper to aquaria. Any loans made to me will be punctually and thankfully returned."

Smithsonian Institution, Washington, U.S.—The annual report for 1876 has lately been issued. It contains a statement by the director, Professor J. Henry, on the work and progress of the Institution, and a report from Prof. S. F. Baird on the Centennial Exhibition. Then follow biographies of Gay-Lussac, and that scientific monarch, the present Emperor of Brazil; articles on the Kinetic Theories of Gravitation; Revolutions of the Crust of the Earth; Asteroids between Mars and Jupiter; and several ethnological articles, altogether forming a handsome volume of some 500 pages. The report and other publications of the Institute are, we believe, presented to Societies who send copies of their reports and transactions to the agent for the Smithsonian Institute, Mr. W. Wesley, 28, Essex Street, Strand. Another important feature in the work of this valuable Institution is that it undertakes to receive books, specimens, &c., from any part of the world for American Societies and Museums, and transmits in return any exchanges which may be desired. During the year 1876 no fewer than 4,853 packages were received from abroad, and some 13,000 parcels sent out. These have been carried free of cost by the various Atlantic Steamship Companies, and thus carriage from any part of the United Kingdom need only be paid as far as London.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—GENERAL MEETING, December 18th, 1877.—Mr. J. F. Goode read a paper on the "Planet Mars," in which he especially alluded to the recent "opposition," as having been of more than ordinary interest from the close proximity of the planet to the earth; the varying distances from which he explained being occasioned by the ellipticity of its orbit. The various features of Mars, as seen through the telescope, were discussed, and a description given of its continents and seas; its snowy poles analagous to those of the earth, its period of rotation on its axis, duration of seasons, and other interesting phenomena, were severally alluded to. Mr. Goode mentioned that the discovery of two satellites by Professor Hall, of the Washington Observatory, had rendered the recent "opposition" particularly interesting. These satellites, he stated, are very small, and are visible only by means of the most powerful instruments, under very favourable circumstances.

CHELTENHAM NATURAL SCIENCE SOCIETY.—On 15th December, 1877, a public meeting was held, at which it was resolved to form a Natural Science Society in Cheltenham. A committee was appointed, and a secretary *pro tem.* Rules, &c., have since been framed. January 18.—First general meeting, at which it was resolved that the society be called "The Cheltenham Natural Science Society," that Dr. T. Wright, M.D., F.G.S., be president, and Colonel H. Basevi honorary secretary. The report of the committee was unanimously adopted, and the rules as added to and altered passed. The ordinary meetings will be held on the 3rd Thursday in each month, April to October inclusive.

NORTHAMPTON NATURALISTS' SOCIETY.—January 7th, a paper "On Beetles" was read by Mr. E. B. Pressland.—January 15th, a paper on "Photography" was read by Mr. H. Manfield.

NOTTINGHAM NATURALISTS' SOCIETY.—January 2nd, Annual General Meeting, when Mr. A. H. Simpson was elected president; Messrs. H. Blandy and J. Morley, vice-presidents; Mr. C. Wheatley, treasurer; Mr. C. T. Musson, hon. secretary; Messrs. W. Foster, W. Morley, R. Wix, R. T. Higham, T. Bull, and J. S. Radford, the committee; and Mr. L. Lee, assistant secretary and librarian.—January 9th was spent as a microscopical evening.—January 16th, the President delivered the Annual Address.

STROUD NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.—January 8th, Mr. J. T. Fisher delivered a lecture on "The Spectroscope in relation to Stellar and Solar Physics," illustrating some of his remarks by a number of photographs.—January 24th was an extra meeting, at which Mr. C. Playne read a paper on "Water as a Motive Power."

TAMWORTH NATURAL HISTORY, GEOLOGICAL, AND ANTIQUARIAN SOCIETY.—On January 7th, Mr. Samuel Spruce, F.G.S., read a paper entitled, "Geological Notes on the Trip to Clent Hills," which he illustrated by plans and diagrams, showing the various strata between Birmingham and Hales Owen. Mr. Spruce showed that the Clent Hills are composed of new red sandstone, and not trap, as erroneously supposed by Hugh Miller and others. He also compared the trap of the Rowley Hills with that of Dosthill. The formation of the Clent Hills

Mr. Spruce believes to be due to denudation, while the Rowley Hill and Dosthill are of volcanic agency. This latter view, he contends, is borne out by the fact of the coal measure at Dosthill lying so near the surface, having been lifted up during an eruption by the lava, which forms the Trap Hill.—On January 21st Mr. Thomas Cooke read a paper on "The Feudal Times," in which he traced the history of feudal tenure, customs, &c., from the Saxon to the Tudor period.

WEST LONDON ENTOMOLOGICAL SOCIETY.—At a meeting held on January 4th, Mr. Silcock exhibited some pupæ of *A. grossulariata*, which is a very rare occurrence, as this species usually passes the winter in the larvæ state. Underneath the currant trees on which the pupæ were taken he found many hybernating larvæ. It was resolved that this society should take part in the forthcoming "Great National Entomological Exhibition," to be held at the Royal Aquarium, Westminster, during the present month.—E. H. Maycock.

Hints to our Contributors.

Write plainly.
Write on one side of the paper only.
Write all names legibly in printed characters, and spell them correctly.
Forward communications as early as possible, so that proofs may be sent for revision.
Original observations should be vouched for by the writer's signature or initials, and address.
Communications should be as brief as possible consistent with clearness.

Exchange.

Exchange.—I have for exchange Vols. XI., XII., XIII., XIV. of Monthly Microscopical Journal, and five Parts of Vols. I. and II.; The Geological Record for 1875; Reports of the Smithsonian Institute, 1873 to 1876; Commonplace Book of John Milton (Camden Society, 1876); Presidential Addresses to the Geological Society, Forbes 1854, Portlock 1858, Ramsay 1863, Smyth 1867, with Proceedings of Royal Society 1866; Geological Survey of United States, Annual Reports 1867 to 1869; and Survey of Wyoming, by Hayden.—Wanted.—Geological Magazine; Science Gossip; Vols. I. to XIV. of Geological Society's Journal; Transactions of Local Societies; or any good Scientific Books.—Apply to Flint-flake, *Herald Office*, Birmingham.

Answers to Correspondents.

Our Walsall correspondent's lines are not suitable for our pages.

We have to express our thanks for many appreciative and encouraging letters, some of them containing useful hints, which have been or will be acted upon.

We shall be glad to receive communications from the members of Natural History Societies in any part of the kingdom.

We cannot undertake the return of rejected papers, unless accompanied by a stamped addressed cover.

PARASITES OF MAN.*

BY T. SPENCER COBBOLD, M.D., F.R.S.

I feel sure I need not apologise for bringing under the notice of workers in Science a list of the human Entozoa and Ectozoa. No complete and trustworthy record, brought down to the present time, exists. In view of rendering my list less bald than a mere catalogue of species would inevitably prove, I shall append a few particulars relating to the synonymy of each parasite, its larval condition, and the organ or tissue of the host it usually occupies. Omitting the Protozoa, I confine my attention to the following six parasitic groups:—1. *Trematoda;* Flukes. 2. *Cestoda;* Tapeworms. 3. *Nematoda;* Roundworms and Threadworms. 4. *Acanthocephala;* Thorn-headed worms. 5. *Insecta;* including all such dipterous, aphanipterous, and hemipterous insects as are either wholly or partially parasitic. 6. *Arachnida;* including all those trachearian forms, such as the mites and their allies, which are often vulgarly and erroneously termed scab, or itch-insects. Such is the bill of fare that I have now to offer, and, should it be found presentable and useful, it is proposed to follow it up at some future time by the publication of similar lists relating to the parasites of the horse and other domesticated animals.

As I cannot have the pleasure of reading these papers personally to the Section, and as I am desirous of making them as generally interesting to the members as the subject will permit, I have requested my friend, Mr. W. R. Hughes, to communicate the papers, and to exhibit some specimens † on my behalf. The slides and preparations from my cabinet will be chiefly illustrative of the more remarkable forms of Entozoa enumerated in the lists.

TREMATODA.

1.—*Fasciola hepatica*, Linnæus.
Synonymy.—*Distoma hepaticum*, Retzius and Ramdohr; *Planaria*, Goeze.
Larval state.—An armed Cercaria; not yet distinguished. Free ciliated embryo conical.
Intermediate Host.—Not known. Probably a fresh water snail.
Remarks.—The common liver fluke of Ruminants has been found at least fifteen times in the human body.
Literature.—All standard works on Helminthology (Leuckart, Davaine, Küchenmeister, Dujardin, Cobbold.)

2.—*Distoma lanceolatum*, Mehlis.
Syn.—*D. hepaticum*, Zeder and Rudolphi; *Dicrocœlium*, Dujardin and Weinland; *Fasciola*, Bloch; *Planaria*, Goeze.
Larvæ.—Cercaria, form unknown. Free ciliated embryo globular.
Int. Host.—Not known. Probably a fresh water snail.

* Read before the Microscopical Section of the Birmingham Natural History and Microscopical Society, February 19th, 1878.

† The specimens exhibited were, the common fluke, *(F. hepatica,)* the lancet-shaped fluke, *(D. lanceolatum,)* the large human fluke, *(D. crassum,)* the Chinese or McConnell's fluke, *(D. sinense,)* the conjoined fluke, *(D. conjunctum,)* the minute Egyptian fluke, *(D. heterophyes,)* and Bilharz's fluke *(B. hæmatobia.)*

Remarks.—Has thrice been found in man. Infests the liver.
Lit.—All standard works, especially that of Leuckart.

3.—*Distoma crassum*, Busk.
Syn.—*D. Buskii*, Lankester; *Dicrocœlium*, Weinland.
Larvæ.—Unknown.
Int. Host.—Not known. Probably a species of oyster.
Remarks.—Infests the duodenum. Found at least thrice in man.
Lit.—Cobbold; Synops. of the Distomidæ in Linn. Proceed., 1860; *Idem.*; Obs. on the large fluke, with notes of two cases in which a missionary and his wife were the victims; Linn. Soc. Proc., Vol. XII. (zool. div.;) and in The Veterinarian, 1876.

4.—*Distoma sinense*, Cobbold.
Syn.—*D. spatulatum*, Leuckart.
Larvæ.—Unknown.
Int. Host.—Probably a fresh water mollusk.
Remarks.—Infests the liver of Chinese. Discovered by Professor McConnell.
Lit.—McConnell; *Lancet* for August, 1875; Macgregor; *Glasgow Medical Journal* for January, 1877.

5.—*Distoma conjunctum*, Cobbold.
Syn.—None.
Larvæ.—Unknown.
Int. Host.—Probably a small mollusk.
Remarks.—Infests the liver. Originally found by me in an American fox (1858,) and subsequently by Lewis in pariah dogs (1872,) and afterwards by McConnell in man (1875.)
Lit.—Cobbold; Synopsis *(l. c.)* 1859; Lewis; Govt. Rep., Calcutta, 1872; McConnell; *Lancet*, Feb., 1876.

6.—*Distoma heterophyes*, Siebold.
Syn.—*Fasciola*, Moquin-Tandon; *Dicrocœlium*, Weinland.
Larvæ.—Unknown.
Int. Host.—Unknown.
Remarks.—Infests the intestine. Only once found. Discovered by Bilharz, at Cairo, 1851.
Lit.—All standard works, more particularly that of Leuckart.

7.—*Distoma ophthalmobium*, Diesing.
Syn.—*D. oculi humani*, Gescheidt; *D. lentis*, Von Ammon; *Dicrocœlium*, Weinland; *Monostoma*, Nordmann; *Festucaria*, Moquin-Tandon.
Remarks.—Several times found in the eye, but as all the specimens were sexually immature, the species, as such, is of doubtful authenticity.
Lit.—All standard works.

8.—*Tetrastoma renale*, Delle-Chiaje.
Syn.—None.
Remarks.—Supposed to infest the kidney. Discovered by Lucarelli in 1826.
Lit.—Delle-Chiaje, Elmintografia Umana, 1833.

9.—*Hexathyridium pinguicola*, Treutler.
Syn.—*Hexastoma*, Cuvier; *Linguatula*, Lamarck; *Polystoma*, Zeder.
Remarks.—Only once detected. It was lodged in a small tumour of the size of a nut.
Lit.—Treutler; Obs. path. anat. ad helm. corp. humani, 1793.

10.—*Hexathyridium venarum*, Treutler.

Syn.—To the genera given above, add *Hexacotyle*, Blainville.

Remarks.—Said to have been found on four occasions; by Treutler once, by Delle-Chiaje twice, and once by Follina. Infests the blood.

Lit.—As above; and in general treatises.

11.—*Amphistoma hominis*, Lewis and McConnell.

Syn.—None.

Larvæ.—Unknown.

Remarks.—Infests the intestine. Twice found; in the first instance by Dr. O'Brien, of Gowatty, and Dr. Curran together.

Lit.—Lewis and McConnell; in Proceed. of the Asiatic Soc. of Bengal, 1876.

12.—*Bilharzia hæmatobia*, Cobbold.

Syn.—*Distoma hæmatobium.* Bilharz; *Gynæcophorus*, Diesing; *Thecosoma*, Moquin-Tandon; *Schistosoma*, Weinland.

Larvæ.—Cercaria unknown. Free ciliated embryo cone-shaped.

Remarks.—Infests the veins, especially the portal system of blood vessels. Frequent in Africa.

Lit.—In standard works; the details being chiefly from Bilharz, Griesinger, Harley, and Cobbold. See also Sonsino; Sugli ematozoi come contributo alla Fauna entoz. egiziana; Cairo, 1877; and in Arch. Gén. de Méd., for June, 1876.

[TO BE CONTINUED.]

ON THE STUDY OF THE MOSSES.

BY JAMES E. BAGNALL.

> Meek creatures! the first mercy of the earth, visiting with hushed softness its dintless rocks; creatures full of pity, covering with strange and tender honour the scarred disgrace of ruin—laying quiet finger on the trembling stones, to teach them rest. No words, that I know of, will say what these mosses are. None are delicate enough, none perfect enough, none rich enough. How is one to tell of the rounded bosses of furred and beaming green,—the starred divisions of rubied bloom, fine-filmed, as if the rock spirits could spin porphyry as we do glass,—the traceries of intricate silver, and fringes of amber, lustrous, arborescent, burnished through every fibre into fitful brightness and glossy traverses of silken change, yet all subdued and pensive, and framed for simplest sweetest offices of grace? They will not be gathered, like the flowers, for chaplet or love-token; but of these the wild bird will make its nest, and the wearied child his pillow.
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> And, as the earth's first mercy, so they are its last gift to us: when all other service is vain, from plant and tree, the soft mosses and gray lichen take up their watch by the head-stone. The woods, the blossoms, the gift-bearing grasses, have done their parts for a time; but these do service for ever. Trees for the builder's yard, flowers for the bride's chamber, corn for the granary, moss for the grave.
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> *Ruskin's "Modern Painters."—Vol. V., pp.* 102-3.

A walk through green fields, country lanes, or woods, is rendered more enjoyable, and I believe more conducive to healthy exercise, if we have some special study to call us there, than such a walk would be if indulged in for the mere sake of what is termed a constitutional. For it is well to have something that will for a time enable us to forget the

every day cares of a busy life, and nothing is so likely to do this as some pursuit that not only engrosses the attention but also gladdens the eye, that calls forth healthy thought, educates the observing faculties, and stimulates us to take a certain amount of invigorating exercise. To any person with ordinary enthusiasm, interest, and industry, the study of the mosses will yield all this and more.

Too frequently these plants are neglected by even professed botanists. The investigation of them is considered to be too difficult, or too tedious, and often too expensive. That there are difficulties connected with the study all must admit, but none that a little patience and industry will not surmount; the tedium of the study would evaporate after the first few hours' examination of these beautiful organisms, and the expense after the first outlay need not be more than a little extra wear and tear of one's shoe leather.

To say that the study of these plants is interesting would be trite, for everything in beautiful nature is interesting, but the "dim world of weeping mosses" is wondrously interesting; so varied in structure, in form, in mode of growth, in colour, covering the bosom of their mother earth with a green, velvety mantle when the cold winds of autumn and winter have robbed the trees of their beautiful foliage, and the nipping frosts have chilled into death their lovely sisters, the flowering plants, clothing with beauty the wayside bank, clinging with a tender embrace to their high-born kinsman the forest tree, bedecking with a thousand fairy urns the old ruined wall, covering with beautifully mingled masses of feathery *Hypnum*, tufted *Bryum*, or hoary *Tortula*, of every shade of green, the rotting thatch of the ruined cottage, filling the treacherous bog with pale green *Sphagnum*, or beautiful tussocks of noble looking *Polytrichum*, flourishing amid the unpleasant odours of the poison breathing marsh, and climbing slowly, but surely, from the lowest valley to the snow line of the great mountain!

And were we to follow them in their daring scramble, and note them well, we should see that the mosses are not only countless in numbers, but multitudinous in varieties and species; the moss flora of our own islands alone numbering about 140 genera and nearly 600 species, besides varieties without end. A superficial observer would probably be astonished if he were to have pointed out to him the varied species to be found upon a few square feet of a bank "with bright green mosses clad," because to him a moss is a moss and nothing more; and yet in such a limited area twenty or more species may often be found; and many a district that at first sight seems able to yield but a poor moss flora may by a little diligence be proved to be quite prolific. A limited district of some 3,500 acres has yielded the writer nearly 130 species of these plants, all of them beautiful and some of them very rare.

Then it must be remembered that mosses are easily preserved, usually retain their special characters even when dried, may be prepared for the herbarium, and packed in comparatively small compass, and may be examined at any time; for, however shrivelled they may have become by long keeping, a few minutes' soaking in tepid water will restore them

to most of their former beauty, their lovely leaves again expand, the minute cells of which they are built are again filled with fluids, and with the aid of the microscope all their details may be made out as readily as though they had been gathered but an hour ago, so that for real and minute study this may truly be called a fireside one.

For the sake of those who would wish to commence the study, but lack the knowledge how to begin, when and where to seek their plants, and how to distinguish them when found, these hints have been written, and I shall endeavour, as clearly as I can, to supply a few elementary lessons in moss collecting, &c.

Before beginning to collect certain aids are required: these are few and simple. First, a bag or satchel of some kind for stowing away specimens as they are gathered. One of the canvas bags with a strap to sling over the shoulder, such as are now offered from a shilling upwards, will be serviceable and sufficient. Some pieces of good strong newspaper six to nine inches square will be required to wrap up each specimen separately as gathered. These papers should be numbered previous to starting out, using ink rather than pencil, for the mosses will often be wet and pencil marks are then easily obliterated. In order to keep the tufts of moss clean and distinct too many should not be put into one paper. When the paper is filled and folded the number of the package should be entered in the collector's note book, with remarks as to habitat, locality, and date. Such, for instance, as this:—" No. 1. Marly bank, Tythall Lane, near Solihull. Formation, Keuper Marl. Feb. 9th, 1878,' and such other particulars as it may be well to remember.

And here I may observe that at first it would be advisable to collect those mosses only which have their fruit fully matured, and then, when these have been carefully examined and their distinguishing characters mastered, barren specimens may be collected; for many of our rarest British mosses are more frequently found barren than fruiting, and they must not, of course, be neglected. As soon as home is reached each of the packages should be opened, and if time serves roughly examined. If not, they should be placed in the opened papers on the floor of a room where they will be undisturbed, and allowed to get thoroughly dry. It will be advisable at the same time to place a slip of paper with each package containing a copy of the notes from note book. When the specimens are dry they may be again wrapped up and put by for an indefinite time for future examination. If the mosses are allowed to dry in the unopened papers just as they are gathered they will be nearly certain to become mildewed, and will be very unsightly and useless, and thus the trouble of collecting will have been taken in vain.

All these details may seem to make the preliminary work very tedious to the beginner, but he will soon get over any irksomeness he may at first feel, and he will be rewarded by his specimens being saved in good condition.

A pocket lens will be required for the examination of the plants in the field, one having a power of about ten diameters, *i.e.*, about one inch focal length, will be found serviceable, and if with two powers, *i.e.*, one

inch and half-inch, still more so. These lenses, fitted in horn cases, may be obtained from any of our local opticians at from 1s. upwards, the price varying according to the finish of the article. If the School Microscope mentioned below is obtained, one or more of the lenses supplied with it may be made to do service in the field; but, if so used, should always be carried in a small chamois leather bag to protect from scratches.

It is advisable to acquire the habit of constantly using a lens, making out by its aid all the details possible, such as the position of the leaves on the stem, general characters, &c., noticing whether they are straight, curved, falcate, and so on, and their direction when dry. This latter character is often a ready guide to nearly allied species. For instance, two mosses common on wall tops, *Bryum capillare* and *B. cæspiticium*, differ materially in appearance when dry, the former having the leaves remarkably twisted, the latter having them straight and imbricated. Many other like cases might be cited.

A good text book will, of course, be indispensable. There are several to select from, published at various prices. For instance, Stark's "British Mosses," having twenty coloured plates, is offered for 5s.; but this is not to my thinking a satisfactory book, the descriptions being too vague to be useful; still, many of the more frequent mosses may be made out from it. Berkeley's "Handbook of British Mosses," with twenty-four coloured plates, costs 21s. new, but may frequently be obtained second-hand for about 14s. The great fault of this work is that the nomenclature is not in all cases that most generally adopted, and the author gives no synonyms. This, I think, is a serious fault, as it leaves one in uncertainty as to the name adopted by other authors. Of cheap books the one I prefer is C. P. Hobkirk's "Synopsis of the British Mosses," which costs 7s. 6d. The only fault is the absence of plates. It is so handy in size that it may be carried in the pocket without inconvenience, contains excellent descriptions of all our British mosses, and the classification adopted in it is excellent. But the best text book is Wilson's "Bryologia Britannica." It contains excellent illustrations of all the mosses described in the volume, giving figures of many of the minute details. The descriptions are admirable, being those of one of the best bryologists our country has produced. Any student who makes good use of this work will find that most of the difficulties surrounding this study will be rapidly overcome. This is a somewhat expensive book, costing 42s. with the plates uncoloured, or 84s. with the plates coloured. The uncoloured edition is to my thinking quite as useful as the more expensive one. I should certainly advise the student to get this volume as his text book.

Of course a microscope will be almost, if not quite, indispensable. These instruments, as everyone knows, are very varied in price, a first-class microscope being an expensive luxury, though there are in the market excellent instruments at most moderate prices. But a great amount of good work may be done with a cheap microscope—in fact, a great deal of the best work that has been done for science has been done with comparatively inexpensive instruments.

The most useful cheap instrument I know is Field's School Microscope, a very compact little instrument having three simple lenses which, separate or combined, give a magnifying power of from five to forty diameters. This, with the simple lenses, live box, needle, and other appliances, costs 10s. 6d.; a compound body may be added for 2s. 6d. extra. This will give powers of from twenty to eighty diameters. It is well to have this compound body at first, as the cabinet is then made of sufficient size to hold the compound body and all the other apparatus. For an additional 2s. 6d. a Wollaston doublet may be added; and, as this lens is a combination of plano-convex lenses placed in such a manner and of such a focus as to reduce chromatic and spherical aberrations, for 15s. 6d. it is possible to possess a microscope nearly achromatic, giving a power of 120 diameters, which is sufficient for almost all the work which the young botanist will have to do. All my own earliest work in mosses was done with this instrument, and I believe I learned more by its aid than I have ever done with the more expensive instruments I have since used. As a simple microscope it will always be useful for dissecting and mounting purposes, and I can say with confidence that the student who has acquired all the knowledge of structure that this cheap little instrument will place within his reach will have gained such an insight into the moss world as will enable him to determine with a little patience the most difficult of mosses.

CASTLETON: ITS EXTINCT FAUNA AND PHYSICAL SURROUNDINGS.

BY THE REV. W. H. PAINTER.

It was upon one of the few fine mornings at the end of August that I stood upon the edge of the high land overlooking the Vale of Hope, and looked down upon Castleton. Before me, in the far-off distance, were the hills in the direction of Sheffield that appeared to form the eastward termination of the vale, while on my left appeared the sharp peak of Win Hill, the more rounded summit of Lose Hill, and, very close to me, the precipitous side of Mam Tor, of which more anon. Then on my right were seen the road gradually winding up the hill-side to Tideswell, the grey ruins of the ancient stronghold of the Peverils, and the bleak moors which characterise that part of Derbyshire.

The exact spot where I stood to view the Vale of Hope was a remarkable one. It was just on the edge of the great plateau of mountain limestone. Behind me stretched that formation, before me lay the Yoredale Rocks overlying the same. These rocks, which take their name from the valley of the Yore, or Ure, in Yorkshire, where they are most fully developed, are beautifully exposed in the steep escarpment of Mam Tor, or the Shivering Mountain. Here they will be seen to consist of alternate layers of sandstone and shale—the latter being impregnated with oxide

of iron. In some of the nodules of impure limestone I found, in examining them upon the occasion of a former visit, cavities filled with dried bitumen, and several specimens of a species of *Modiola* and *Goniatites reticulata.*

Upon the opposite site of the road, the western, is the famous Windy Knoll Quarry—the scene of the labours of several farmers, of some students of Owens College, Manchester, and last, but not least, of Mr. Rooke Pennington. This quarry is remarkably situated. It is near to the most northern point of the mountain limestone of Derbyshire, and in the direct line of route from the Cheshire plains to the Vale of Hope. To quote the words of Mr. Pennington in the "Quarterly Journal of the Geological Society for May, 1875," "the Yoredale beds dip northwards: a fault runs close to the spot. The line of division between the mountain limestone and the overlying rocks runs, roughly speaking, to S.E. and S.W. of this quarry." But that which has served to render this quarry famous has been the discovery of a fissure filled with the remains of extinct animals. Certainly, it *has* been a remarkable place. I say it *has been*, for when I visited it, last August, all trace of it, with the exception of a few splinters of bones, two specimens of the tarsus, and one of the humerus of the Reindeer, had disappeared; the rock having been blown down, and the bones taken away.

It would appear as if this fissure lay in the track of animals making their way from the Cheshire valleys and plains to the Vale of Hope, and that connected with it was a swampy pool, to which they went to drink; that the weak ones stuck fast in the mud, from which they were unable to extricate themselves; that whilst in this predicament they fell an easy prey to bears and wolves, whose bones, in their turn, became mingled with those of their victims. The bones found in this fissure were of all parts of the animals:—The bison *(Bison priscus,)* the reindeer *(Cervus tarandus,)* the grisly bear *(Ursus ferox,)* the wolf (*Canis lupus*,) the fox (*C. vulpes*,) the hare (*Lepus timidus*,) the rabbit (*L. cuniculus*,) and the water-vole (*Arvicola amphibia*.) Before passing on we must notice the remarkable bed of elastic bitumen which is found here, overlying a mass of mountain limestone, on the south side of the quarry. Besides this a great mass of limestone on the north side of the quarry has become so saturated with the bitumen that when placed in a fire it burns with a clear, bright flame. In this last-mentioned limestone I found an internal cast of *Euomphalus Dionysii*, two species of *Productus*, two of *Athyris*, one of *Spirifera*, and a beautiful specimen of *Conocardium minax*.

Leaving this interesting quarry we proceed to the Blue John Mine in Traycliff. This mine is the grand depository of the amethystine or topazine fluor spar, locally called "Blue John," to distinguish it from "Black Jack," or zinc ore. This substance is composed of lime and fluoric acid, the most penetrative and corrosive of any acid known; the blue colouring matter being oxide of manganese. Descending by a flight of steps, a narrow confined passage is reached, that winds between the rocks. From the roof of this passage stalactites are pendant, whilst in the sides crystals of carbonate of lime glisten. After descending for a short time,

the variegated cavern is reached—a large chamber, said to be upwards of 100 feet in height. But this is not the only large chamber that has been discovered through the labours of the miners. Some distance from this cavern is the one called "Lord Mulgrave's Dining Room"—a large cavity about 150 feet in height, and 60 feet in diameter. But the most beautiful of all the chambers is that called the "Crystallised Cavern," a large dome-shaped cavity, the height of which is estimated at 100 feet, and whose sides are adorned with numerous stalactites, that sparkle like stars when it is lighted up.

Another of the Peak mines is the Speedwell Mine, the gallery of which was originally excavated by a company of proprietors in search of lead ore. Access to the interior of this mine is obtained by descending about 104 steps, then by proceeding in a boat along a level or tunnel, the result of the miners' operations, to the Grand Cavern, a vast vaulted chamber, fashioned by natural forces in the heart of the mountain, the height of which has never been ascertained, but is supposed to exceed 500 feet, since rockets capable of ascending 450 feet have been sent up and have exploded and thrown out their coruscations as fully as if they had ascended beneath the vault of heaven. On one side of this chamber is an abyss which has never been fathomed. On the day that I visited it a vast body of water was pouring into it from some of the old workings, which precipitated itself into the chasm with the noise of thunder. This was owing to the rain having fallen almost incessantly for some days, as in the usual course of things visitors are able to throw stones down and hear them bound from side to side for some minutes.

The greatest of all the Peak caverns is the "Peak Cavern," or "Devil's Hole," the approach to which is through a ravine by the side of the stream which issues from the cavern. At the termination of this ravine there is a magnificent natural arch in the solid rock, 120 feet wide, and 42 feet high. The mode of progress in this cavern was formerly by a boat for short distances, but latterly, for the convenience of visitors, passages have been made by blasting the rock. After proceeding for some distance a large chamber, called the "Grand Saloon," is reached, about 220 feet square, and in some places 120 feet in height. Leaving this apartment by means of a steep and rugged pathway, the "Chancel" is reached, and then descending by another path the visitor arrives at the "Devil's Cellar." The other large chambers in this cavern are "Gloucester Hall" and "Great Tom of Lincoln," the latter being so designated from its having a regular concavity in the roof resembling the form of a bell.

On the eastern side of the Castle Hill runs Cave Dale, a rocky glen, in which the mountain limestone is well exposed. The approach to this narrow defile has rather a forbidding aspect, the entrance being by a cleft in the hill-side not more than five feet wide. Passing this the dell widens out and gradually ascends for about a mile. As the visitor ascends towards the summit he passes on his way a singular column of toadstone, not unlike in appearance to the basaltic

columns of the Giant's Causeway, and obtains lovely views of the old keep of the Castle and of the hills separating Edale from Hope Dale. In this dale the geologist will meet with a rich variety of fossils. *Cardiomorpha oblonga*, *Rhynchonella pugnus* and *pleurodon*, *Terebratula hastata*, *Spirifera glabra*, *Conocardium minax*, and species of *Nautilus* may be found.

Cave-hunting in this dale has been carried on successfully by Mr. Rooke Pennington. He discovered some time since underneath the keep of Peveril Castle a small cave, which has furnished a few articles, showing that it had been occupied by man at various periods from the (so-called) Neolithic age down to a comparatively recent period. Amongst the relics obtained were a shilling of Queen Elizabeth's reign; pieces of old-fashioned pots of a later reign, mingled with bits of "rude pre-historic pottery;" bones of the Celtic Short Horn (*Bos longifrons*,) goat (*Capra hircus*,) and hog. Of animals not connected with man there were many teeth and bones of the fox (*Canis vulpes*,) badger (*Meles taxus*,) and a skull of the water-rat (*Arvicola amphibia*.) Of implements, &c., there was a tooled piece of stag-horn, an iron spike, two flints, a piece of jet, part of a bone comb, and a magnificent bronze celt. There was thus a distinct proof of this cave having been used, first, at some remote period as a place of sepulchre, by the presence of human teeth and a fibula; and, secondly, at a more recent period by the indications above-mentioned, as well as by the discovery of an antler of a red deer, half-sawn through and then broken off, and the bones of a dog and of a hog.

Another notable place in the neighbourhood of Castleton is the "Winnats" or Windgates, a narrow defile between lofty limestone cliffs, through which the high road to Manchester formerly ran. Exceedingly wild and grand is the appearance presented by this pass; on each side stupendous piles of mountain limestone rise to a great height, with their summits split and rent into a variety of forms, some assuming the shape of ruined castles; in some places huge, buttress-like masses protrude into the road, whilst in others lie shattered fragments of rock which, having become detached from the hillside above, have been hurled down, and are seen scattered abroad in wild profusion; whilst at the lowest part of the defile a gigantic pile of rock, round which the road winds, appears to close in the ravine.

Opening out from Hope Dale are numerous other dales of great loveliness, as Edale, &c. The origin of these may be traced to denudation, the action of water having, in the course of ages, swept away the Yoredale shale where it occurred, leaving the harder rocks which form the hills *in situ*. To this cause the origin of most of the undulating scenery of Derbyshire must be attributed, streams that descended from the heights having first undermined the softer strata and then carried them away. Good examples of the action may be seen on the lower flanks of Kinder Scout, and notably at Mam Tor; and where only the lower limestone beds occur it is not to be doubted that water has been the chief agent in excavating the dales—first by cutting out subterranean channels for itself, as in the case of the before-mentioned caverns, and

then, the roof of the cavern having fallen in, by gradually widening it, and so converting a cave into a ravine. Similar instances of this kind of action I have also met with at the base of Ingleborough, in Yorkshire.

The district of which Castleton is the centre is one in which the student of the marvels of creation will find much to instruct and interest him. Here he will find a record of some of the changes to which our globe has been subjected at the hands of Him who by His Almighty fiat said "Let the waters under the heavens be gathered into one place and let the dry land appear;" who has settled the bounds of the different animals inhabiting the same, and who has fitted it for the welfare and happiness of man, the last and greatest of His productions.

PROFESSOR EDWARD FORBES AND HIS COUNTRY.

BY ROBERT GARNER, F.L.S.

Since any district or hunting-ground which is appropriated to the study of natural history loses much of its productiveness and interest if it does not embrace a portion of the seaboard, or, at any rate, if there is no occasional excursion made with the object of studying marine zoology and botany, the following paper relating to one portion of the Isle of Man may not be out of place in the "Midland Naturalist," especially as its coasts, together with those of North Wales, are more easily accessible to Midlanders than any others, and the island is especially rich in all marine productions, whether botanical or zoological.

When the writer of this paper saw for the first time the still-regretted Naturalist whose name occurs at the head of it, he could not fail to be struck with his intellectual appearance, juvenile look, expressive eyes, and somewhat truant hair. This was in 1839, as he spoke in his section at the meeting of the British Association at Birmingham, the year and place, we think, which gave birth to the Red Lion Club, consisting of himself and other congenial spirits. His then auditor, who was also his senior, little expected that so many years after his death, (which took place in 1854,) circumstances which may be termed fortuitous would bring it about that himself, with tastes not very different from those of poor Forbes, should become acquainted with the family estate, and be domiciled for a time at the homestead which belonged to him; also hear his praise from the worthy old Manxman who accompanied him in his rambles and dredgings; to whom, as to all with whom he had intercourse, he became much endeared. The old man recounted, amongst other things, with what glee Forbes found a rare *Arca (tetragona)* in the mud which filled the valves of a *Modiola;* his *gourmandise* in respect to the raw mollusks of the scallops, (called *tanrogans* by the natives;) his long and lithe fingers allowing nothing to escape them; and the interest he took in a beetle which the narrator brought to him—three-spined, and which burrowed in the roads—probably a *Typhœus* or bull-comber, (Anglice.)

Edward Forbes was born at Douglas, in 1815, and was consequently but thirty-nine at his death. His mother was the heiress of Corvallo and Ballabeg, near Ballaugh. He was of a stock not only adventurous, but speculative, on the male side. In the wreck of the family estates, which had become involved previous to his succession to them, he only succeeded in saving a portion—that above alluded to. The old parish church is close at hand, a mile at least from the village, but is now a disused and picturesque edifice; the surrounding enclosure contains one of the Runic memorial stones so general in the island; but a more interesting stone, at least to the naturalist, may be seen in the otherwise uninteresting modern church, a tablet raised in 1858, principally through the aid, we believe, of Sir R. I. Murchison and other scientific friends, to the memory of the professor, the inscription ending so—

> His mother was a native of Ballaugh,
> Here he spent many of his boyish days,
> And on the sea-coast of this parish
> He commenced his system of dredging.

His bust is also placed in the Court House at Peel.

He went up to London, when a young man, with the determination to become an artist, but his friends saw reasons to dissuade him from such a career, and, by so doing, the world may, perhaps, have lost a clever caricaturist, but probably not a painter. His tastes next led him to turn to geology and natural history; but at that time natural science was considered only as an appanage of, or a relaxation in the study of medicine, and, therefore, he had to go through the *curriculum* of the latter profession, which, however, he had little taste for. In producing his geological and zoological bias it is probable that his residence in Manx-land, and the natural features of that country, had an influence; and to these features we may further advert taking them in connection with himself. For more, perhaps, than any other man he made the natural history of his native island his study, though our late friend, Mr. Cumming, did much.

As regards his geological bias—the southern four-fifths, at the least, of the island are composed of metamorphic and Cambrian slates and other succeeding palæozoic rocks,and are more or less mountainous; the northern and lesser portion is of a very different formation—boulder clays and drifts resting on a foundation which is nowhere visible, and of problematic nature. The surface here is mostly a sandy plain, with an occasional bog or curragh marked by a curious and luxuriant vegetation; in some places, however, the sand forms many rounded hills, and, besides, many ancient mounds and other earth or stone works mark the surface. Thus, on the estate we have especially alluded to is an antiquity combining the stone circle with the earthen barrow—a mound of earth with its periphery supported by large quartz stones. The glacial deposits are found high up amongst the hills, and at a lower level, as displayed along the sea-cliffs, there are truly wonderful accumulations of gravel and fragments of rocks, without any stratified arrangement; larger boulders, too, are washed out of the clays in the valleys, or by

other means perched on the hill sides; and such as are of white quartz have been used to mark boundary lines, or are often placed round ancient interments as already instanced. On Maughold Head, at about 300 feet of elevation, lies a large "erratic block" of greenstone, strongly marked with grooved and crossed lines. Above, and filling up the ploughed surface of the earlier accumulations, are horizontal deposits of sand, peat, and marine shells, the latter such as now live in the sea close at hand, but deposited higher than its waves can now reach. On this north-western part of the island, the coast is of a nature to disintegrate, the wind redistributing the sand into "broughs" or hills, imperfectly kept together by the growth of lyme-grass and mat-weed; at the extreme north—the Point of Ayre—the sands, probably thrown on shore by currents, are drifted by the same agency into parallel undulations or ridges, much like the waves of the sea—a truly barren waste, adorned with little but gorse, a plant, however, here not wholly despised, but chopped in windmills for fodder. North of Peel there is a narrow tract of old red sandstone forming the sea-cliffs, and of it the venerable cathedral of St. Germain is in part built; it is there strangely pitted and honey-combed, apparently by the action of the winds. The fragments of shells seen in the hardened sands in this part of the island are perhaps due to wind-drifts. It is in what we may term "Forbes's Parish" that the remains of the great deer or elk *(Megaceros)* principally occur, entombed below the peat of the curragh, and reposing on a bed of shell-marl of fresh-water formation, not much more than twenty feet above the sea level. These curraghs must be partly of recent and partly of pleistocene formation—to use Forbes's term; the latter, because when the elk lived here, its range could not have been so limited as it must have been if the isle were as we see it now.*

The curraghs are of interest in other respects, especially to the botanist. The *Osmunda* is the common fern. Willows, such as *Salix pentandra*, &c., *S. fusca*, and its many varieties, the sweetgale, the bog-bean, the marsh cinquefoil, milfoil, and several other rarer plants, also occur in them. *Pulegium vulgare* is common in wet clay, and on the dry, sandy road I found *Silene Anglica*, *Papaver Argemone*, several species of rose and sweetbriar, with, however, but one *Rubus (fruticosus.)* On a dry bank, near Jurby, was a remarkable potentilla, *(P. hirta,)* scarcely indigenous, though found also near Perth. How the plant got here it is difficult to conceive.

The landscape is somewhat drear, the church towers the most conspicuous objects. Little streams, originating in the marshes, with difficulty find their way to the sea, and enter it, like the Callane, between the sand hills, forming little coves, interesting from the numerous marine plants growing about.† It was in these streams and in the curragh that Forbes fished for Limnæi and Planorbes.

* In a specimen obtained by the writer, but broken below the snags, the measurement from the centre of the forehead to the extreme end of the right horn would be, in a direct line, 4ft. 6in.

† *Arenaria peploides*, *Pyrethrum maritimum*, *Cerastium tetrandrum*, *Eryngium*, *Glaucium*, *Beta maritima*, *Atriplex laciniata*, *Triticum loliaceum*. No plants or shells are recorded, except such as the writer noticed, unless otherwise notified.

By ascending one of the glens, south of Ballaugh, but still in that Sheading, (so called,) we are soon in a different kind of country—in the heart of the hilly part of the island, quite sub-alpine in character. Here the mosses are not low and flat, but commonly high and inclined, becoming constant feeders to the rivulets. They abound with the usual plants—*Drosera rotundifolia*, *Pinguicula*, *Anagallis tenella*, *Scutellaria minor*, *Hypericum elodes*, *Wahlenbergia*, *Aspidium Oreopteris*, *Lycopodia*, *Bryum punctatum*, and, no doubt, others. Frequent waterfalls are here formed, where the streams flow down their rocky beds, and especially where they leave the slate rock for the boulder clays, which the water more easily scoops out. Such is the case at the Spoogt-vane, a pretty cascade, situated in a retired amphitheatre, south of Ballaugh. It is less frequented than Rhenass or Glen Meay, and to some, therefore, perhaps as pleasing, though these are certainly romantic, the last even approaching the grand, where the river finally trends through the rocky ravine to the sea. There are the remains of a Treen Church in the wood, near the Spoogt-vane Cascade. The river abounds with a small dark-coloured trout.*

[TO BE CONTINUED.]

THE RAY AND PALÆONTOGRAPHICAL SOCIETIES: AN APPEAL.

BY W. R. HUGHES, ESQ., F.L.S.

As the principal object of our Union is to promote the study of Natural History, I venture to bring before its members the claims which these admirable Societies have to their sympathy and support.

Perhaps no better illustrations could be given of the successful combination of numbers in effecting results, which are equally beyond the reach of private means on account of their costliness, and of public enterprise on account of the risk and uncertainty of sale, which many of the publications—mostly of a technical nature—would involve.

It is, therefore, not too much to say that, except for the existence of these Societies, many most valuable works in Natural History—on which the talented authors have devoted years of labour as well as much expense—would never have been published.

Having, at the request of my friend, Mr. Wm. Mathews, jun., M.A., F.G.S., (who held the office of local honorary secretary to both Societies for upwards of twenty years,) undertaken to succeed him in the duty of collecting the subscriptions and distributing the volumes, and thus feeling more than an ordinary interest in the welfare of the Societies—this circumstance must be my apology for introducing the subject to the notice of the members of our Union, many of whom are doubtless more familiar than I am with the splendid works which they have issued.

* I gathered *Hypericum androsæmum*, and *Hieracium sylvaticum* below the fall; and at Glen Meay, *Vicia sylvatica* and *Erodium maritimum*.

The Ray Society was founded in the year 1844, and "had its origin in a wish expressed by the late Dr. Johnston, of Berwick, to some of his scientific friends that some means could be devised for printing such works in Natural History as stand in need of extraneous assistance to secure their publication." Many of the honoured pioneers who constituted the first Council—names then and since celebrated in almost every branch of Natural History—have passed away, but some happily survive. Among the latter may be mentioned Professors Babington, Balfour, Busk, and Owen, the Rev. M. J. Berkeley, and Sir P. de Malpas Grey-Egerton, Bart. The first officers were—President, Professor Bell; Secretary, Dr. Lankester; Treasurer, Dr. Bowerbank; and Auditors, Messrs. E. J. Quekett and Robert Warington. The number of members was 225, the subscription being one guinea each. The first annual meeting was held on 2nd October, 1844. Since that date the number of members has increased to more than 400 at the present time, and a sum of about £22,700 has, during the thirty-three years that have elapsed, been expended in the publication of thirty-three Standard Works or Monographs in various departments of Natural History. It would be interesting to append a list of these, but space will not permit, nevertheless, I cannot refrain from mentioning the Monographs of the Nudibranchiate Mollusca, by the late Messrs. Alder and Hancock; the Cirripedia, by Dr. Darwin; the Spongiadæ, by the late Dr. Bowerbank; the Oceanic Hydrozoa, by Professor Huxley; and the Fresh Water Polyzoa and Tubularian Hydroids, by Professor Allman, (for the last of which the Royal Society's Gold Medal has recently been awarded,) as being among the most elaborate and costly works that have ever been issued. To give an idea of the liberal way in which these works are produced it may be interesting to mention that the cost of the publication of the last named work—without, of course, a single farthing being paid to the learned author—inclusive of paper, printing, engraving, colouring, and binding was £900.

The following volumes of this Society are nearly ready, viz., *Spongiadæ*, Vol. IV., *Aphides*, Vol. II.; and the *Copepoda*, Vol. I.; and many other interesting works, are contemplated.

It is probable that the success which attended the establishment of the Ray Society may have induced geologists to wish for a similar organisation for the publication of works on palæontology, which scarcely came within the scope of the operations of the former Society. For this they had not long to wait. "The Palæontographical Society was established in the year 1847, chiefly through the exertions of the late Dr. Bowerbank, for the purpose of figuring and describing the whole of the British Fossils, and has since that period issued thirty-one quarto volumes, containing 8,552 pages and 1,259 quarto plates, and has described 4,623 species of British Fossils, illustrating the plants, corals, echinodermata, crustacea, mollusca, fishes, reptilia, mammalia, &c., of the geological formations." Like the elder Society, the Palæontographical has lost many of its original members who formed the first Council. Those who survive are Professor Bell, Sir P. de Malpas Grey-Egerton, Bart., Professor Prestwich, and Mr. Alfred White. The first officers were:—

President, Sir H. De la Beche; Treasurer, Mr. Searles V. Wood; Secretary, Professor Morris; and Auditors, Messrs. A. G. Melville and J. Tennant. The first list contained 362 subscribers, who have since increased—notwithstanding losses, deaths, &c.—to nearly 500 at the present time, and the amount expended in Monographs during the thirty years of the Society's existence has been £21,200. The plan of publication is similar to that adopted by the Ray Society. Each subscriber of one guinea is entitled to receive a quarto volume, containing from forty to fifty quarto plates and necessary letter-press. It is not found practicable, on account of the comprehensive character of the Monographs, to issue annually one *complete* work at a time, and consequently as many as six *parts* of various Monographs have sometimes been included in the volume. These may be collected and bound together subsequently or the series may be left in chronological order as issued, easy reference being had to any Monograph in particular from the comprehensive indices prepared by the Secretary. In the volume for 1878 there will be eight parts, including two new subjects—the Liassic Ammonites and the Fishes allied to the modern Ceratodus; the completion of an old Monograph —that on the Merostomata; and a particularly interesting treatise on the relation between the Pleistocene mammalia and those of the present historic periods together, the estimated cost being £800. The following are among the more remarkable works published by this society:—The Carboniferous and Crag Foraminifera, the Fossil Corals, the Polyzoa of the Crag, the Echinodermata of the Oolitic and Cretaceous Formations, the Mollusca of the Crag, Eocene, and Great Oolite Strata; the Fossil Brachiopoda, the Fossil Merostomata, the Trilobites, the Belemnites, the Carboniferous Fishes, the Reptilia of the Liassic and Wealden Formations, and the Mammalia of the Mesozoic System, and of the Pleistocene and Crag Formations. The Council state in their last Report that "many years must elapse and many additional writers be enrolled ere the task of figuring the whole of the fossils of the British area be completed."

It has been attempted to be shown within the compass of this necessarily brief account what thorough good work the Ray and Palæontographical Societies are doing to advance the cause of Natural History. From the figures already quoted, it will be seen that an aggregate of more than *forty-three thousand pounds*, or an average of £1,300 per annum, has been expended by both Societies in little over thirty years, and this, be it remembered, has been purely voluntary, and without any help whatever from Government, but frequently supplemented by considerable pecuniary assistance from the talented authors, to whom the subscribers are indebted for the works themselves. It is evident that, with larger resources, the usefulness of both Societies might be greatly extended. At present, for each guinea subscription, the issue is one volume per annum, which might be increased to two if means justified the respective Councils, and thus the publication of many additional valuable works, some of which have appeared for years in the Prospectus, and then been withdrawn, could be undertaken. It would be a graceful act if every Society in our Union, not on the lists, would subscribe, as well as each working naturalist,

individually. Everyone would find something to interest him in one or other of the Societies, and his influence, when once secured, would again influence others. Some of the earlier Monographs are out of print, and already fetch high prices in the second-hand booksellers' catalogues, and, therefore, upon the mere ground of "an investment" subscribers may rely that they will get their "money's worth." The number of subscribers within the area of our Union, a radius of eighty miles, is not more than thirty or forty to both Societies together; a very small number indeed, when we consider its wealth and the number of those who take an interest in Natural History. The subscriptions were due on 1st January last for the current year, so that each member now subscribing will be entitled to the forthcoming volume. Specimens of the recently published works may be seen at my office, 23, Union Street, Birmingham, where I shall be glad to receive the subscriptions of intending subscribers. The Rev. Thomas Wiltshire, M.A., F.G.S., 25, Granville Park, Lewisham, S.E., is the able Secretary to both Societies; and he will, I am quite sure, with his usual courtesy, give any further information that may be desired.

THE WEATHER OF JANUARY, 1878.

BY W. J. HARRISON, F.G.S.

In the following columns we have the pleasure of presenting to our readers by far the most complete monthly return of the Temperature and Rainfall of the Midland Counties which has ever appeared in any publication. It embraces returns from about seventy stations, including three distant points—Carlisle, Ventnor, and Altarnun Vicarage, Cornwall—the returns from which will be useful and interesting for comparison with our own central stations. Many deficiencies, however, remain to be supplied, and we shall be pleased to give information as to description and cost of meteorological instruments.

The influence of the weather upon animal and plant life is a branch of the subject to which we would direct special attention, and we trust to receive many notes for February as to the time of opening of our ordinary spring flowers—Snowdrops, Primroses, the Speedwell, Hazel, Pilewort, *(Ranunculus ficaria,)* Dog's Mercury, and Coltsfoot for example. In this matter our readers generally could render important help.

Reverting to the weather of the first month of 1878, the figures we print below show unanimously that while the rainfall was below the average, the temperature, especially for the first three weeks, was decidedly above it. The maximum rainfall at nearly all stations was on the 27th, but only at Buxton (1·36 ins.) did it exceed one inch in depth. There are one or two returns in which a heavy fall is entered on the 28th, but this we suspect is caused by entering the rainfall to the day on which it was measured. The rain-gauge should be emptied daily at nine A.M., and the amount *entered to the preceding day*. The temperature desired is that in the shade at 4ft. above ground, (thermometers in a Stevenson's stand if possible.) If instruments are placed otherwise it should be noted on the form. We shall be pleased to forward forms for the purpose of recording observations to all who will help in the work of making this record of the weather of the Midlands as complete as possible, and all forms should be filled up and sent within the first week of the ensuing month to Mr. W. J. Harrison, Town Museum, Leicester.

STATION.	OBSERVER.	RAINFALL. Total for M. In.	Greatest fall in 24 hours. In.	Greatest fall in 24 hours. Date.	No. of rainy d.	TEMPERATURE. Greatest ht. Deg	Greatest ht. Date	Great'st cold Deg	Great'st cold Date.
GLOUCESTERSHIRE.									
Cainscross, Stroud	W. B. Baker, Esq.	1·37	·73	26	11	55·0	22	22·0	31
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	2·02	·73	27	16	55·0	21	23·0	30
Thorganby Villa, Shifnal	G. C. Broom, Esq.	1·98	·61	27	17				
Whitchurch	A. B. George, Esq., M.D.	2·66	·57	3	20		28	25·0	30
Woolstaston	Rev. E. D. Carr	2·66	·89	27	21	53·5	21	24·0	26
Leaton Vicarage	Rev. E. V. Pigott	1·65	·56	27	19	55·0	21	22·0	30
More Rectory, Bishop's Castle	Rev. A. Male	2·23	·59	27	21	58·0	2		
Larden Hall, Much Wenlock	Miss F. R. Boughton	2·33	·55	27	17				
Bishop's Castle	E. Griffiths, Esq.	2·19	·56	27	18	52·0	22	25·0	30
Cardington	Rev. Wm. Elliot	2·13	·64	27	16				
Adderley Rectory	Rev. A. Corbet	2·58	·63	27	24				
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	1·42	·54	27	17			22·0	30
Burghill	T. A. Chapman, Esq.	1·48	·67	27	16	57·8	21	24·9	30
Stoke Bliss	Rev. G. E. Alexander	1·64	·62	27	16	55·0	21	24·0	30
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq.	1·85	·71	27	18	56·8	21	23·8	30
Blockley	R. B. Belcher, Esq.	2·04	·62	27	20				
West Malvern	A. H. Hartland, Esq.	1·96	·51	27	19	52·5	21	25·0	25
Pedmore	E. B. Marten, Esq.	2·03	·57	27	21	54·0	15	25·0	10
Stourbridge	Mr. J. Jeffries	1·94	·57	27	14	56·0	18 & 21	20·0	31
STAFFORDSHIRE.									
Barlaston	W. Scott, Esq.	3·15	·70	27	15	53·8	21	17·8	29
Amblecote	Mr. J. Robins	1·58	·55	27	16	56·0	26 & 28	24·0	31
Dudley	Mr. J. Fisher	1·90	·56	27	17	52·0	14 & 20	25·0	31
Sedgley	Mr. C. Beale	1·77	·56	27	16	52·0	21	23·0	31
Kinver	Mr. T. Bolton	2·05	·59	27	23	56·0	21	20·0	31
Walsall	Mr. W. E. Best	2·04	·53	27	21				
Grammar School, Burton	C. U. Tripp, Esq.	2·83	·58	27	21	55·0	21	22·0	30
Patshull Gardens	T. W. Dell, Esq.	1·92	·63	28	12	54·0	15	24·0	31
Weston-under-Lyziard R'tory	Hon. & Rev. J. Bridgeman	2·16	·63	27	23	53·0	21	23·0	30 & 31
Wrottesley	E. Simpson, Esq.	1·95	·69	27	16	54·5	22	20·8	30
Tamworth	W. Arnold, Esq.	2·03	·47	27	18				
Alstonfield Vicarage	Rev. W. H. Purchas	5·92	·92	7 & 14	15	51·8	21	17·0	26
Tean Vicarage, near Cheadle	Rev. G. T. Ryves	3·27	·75	27	21	54·0	21	24·0	30
WARWICKSHIRE.									
Coundon, Coventry	Col. R. Caldicott	1·92	·54	27	19	55·0	21	27·0	30 & 31
Coventry	J. Gulson, Esq.	1·83	·52	27	18	57·0	21	24·0	30
Bickenhill Vicarage	W. R. Capel, Esq.	1·90	·50	27	19	54·0	21	25·5	31
St. Mary's College, Oscott	Rev. S. J. Whitty	1·79	·52	27	20	54·4	21	23·4	30
Henley-in-Arden	T. H. G. Newton, Esq.	1·78	·55	28	11	55·0	21	25·0	30
Rugby School	Rev. T. N. Hutchinson	1·77	·53	3	19	55·0	21	25·0	30
DERBYSHIRE.									
Buxton	E. J. Sykes, Esq.	3·04	1·36	13	24	51·8	21	18·0	30
Brampton S. Thomas	Rev. J. M. Mello	2·28	·40	27	17	53·0	20	22·0	29
Stoney Middleton	Rev. U. Smith	3·71	·66	13	17	53·0	21	16·0	31
Fernslope, Belper	J. G. Jackson, Esq.	2·66	·62	27	23	55·0	21	26·0	25 & 30
Matlock Bath	R. Chadwick, Esq., jun.	3·86	·72	27	19	51·0	21	22·5	25
Linacre Reservoir, Ches'field	C. E. Jones, Esq.	2·05	·58	31	18				
Willesly Gardens, Cromford	J. Tissington, Esq.	3·43	·59	4	15				
Stuffynwood Hall	R. Rolfe, Esq.	2·01	·40	27	19	54·0	21	23·0	24
Old Hall, Spondon	J. T. Barber, Esq.	2·28							
NOTTINGHAMSHIRE.									
Hodsock Priory, Worksop	H. Mellish, Esq.	1·46	·35	27	14	57·4	21	23·1	30
Grove House, Mansfield	W. Tyrer, Esq.	1·97	·46	27	19	55·4	21	24·0	30
LEICESTERSHIRE.									
Foxton Locks	Union Canal Company	1·33	·41	3					
Loughborough	J. Giles, Esq.	2·12							
Belmont Villas, Leicester	H. Billson, Esq.	1·66	·50	27		55·8	21	27·5	31
Syston	J. Hames, jun.	1·78	·34	27	23	58·0	22	25·0	26
Kibworth	T. Macaulay	1·82	·52	27	22				
Waltham-le-Wold	E. Ball, Esq.	1·38	·52	27	14	52·0	21	23·0	25
Little Dalby Hall	G. Jones, Esq.	1·02	·48	27	15	54·0	21	24·0	18, 25, 26, 30, & 31
Town Museum, Leicester	W. J. Harrison, Esq.	1·57	·48	27	19	55·9	21	26·0	25
Market Harborough	S. W. Cox, Esq.	1·65	·48	27	14	53·0	21	22·0	30
Ashby Magna	Rev. E. Willes	1·61	·44	27	19	51·0	21	23·0	30
Coston Rectory, Melton	Rev. A. M. Rendell	1·82	·44	27	17	54·8	21	19·8	18
Belvoir Castle	Mr. W. Ingram	1·71	·42	28	16	56·0	22	23·0	30
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	1·87	·46	27	16				
Castle Ashby	R. G. Scriven, Esq.	1·40	·40	27	15			24·0	11
Sedgebrooke	C. Markham, Esq.	1·32	·47	3	19	57·0	22 & 23	23·0	11
Croyland Abbey	E. Sharman, Esq.	1·60	·86	3	20			16·0	11
Kettering	J. Wallis, Esq.	1·53	·35	27	19	55·0	22	26·0	26
Althorp	W. F. Jakeman, Esq.	1·28	·42	3	16	54·0	21	23·0	10 & 31
Northampton	H. Terry, Esq.	1·18	·33	3	19	56·0	22	26·0	29
RUTLANDSHIRE.									
Burley-on-the-Hill	W. Temple, Esq.	1·31	·32	28	14	62·0	21	23·0	30
Tickencote	W. Hayes, Esq.	1·34	·29	27	14	52·0	21	24·0	18
OXFORDSHIRE.									
Radcliffe Observatory	Mr. J. Lucas	1·52	·51	3	17	56·4	21	25·1	30
CUMBERLAND.									
Spital Cemetery, Carlisle	Mr. T. Bell	3·00	·60	27	21	54·2	6	22·7	30
ISLE OF WIGHT.									
Ventnor Hospital	H. Sagar, Esq.	1·90	·42	27	15	57·6	15	31·0	31
CORNWALL.									
Altarnun Vicarage	Rev. G. Tripp	2·95	·80	26	14	55·0	26	21·0	12

REMARKS ON THE WEATHER OF JANUARY.

HAUGHTON HALL.—Two inches of snow fell on 25th. WOOLSTASTON. Early part of month very mild. Primroses in blossom in first week. LEATON VICARAGE.—Cloudy and mild, with fogs, till 23rd. Snow and rain 24th to 26th, followed by severe frost to end of month. BISHOP'S CASTLE.—Rainfall about half the average of last five years. BURGHILL, HEREFORD. Barometer high, especially from 9th to 20th. Warm period, with high W.S.W. winds, on 21st and 22nd. WEST MALVERN.—Mean Temperature, 38·8°. Barometer, 30·03. BARLASTON.—Rainfall one-fifth of an inch above average. PATSHULL.—A very mild month. BURTON.—First fortnight mild; the last cold and wintry, frequent snow. Skating on shallow pools on 31st. Trent in flood 28th and 29th. WESTON-UNDER-LYZIARD.—Snow 23rd to 25th; snow, with rain, 26th and 27th. Lightning on 25th, between six and seven P.M. TAMWORTH.—Barometer on 12th reached 30·72in. Rainfall below the average. A good month for working on the land. ALSTONFIELD VICARAGE.—Snow fell early on morning of 23rd, and ground remained covered to end of month. COVENTRY.—A mild and open month, with some frosts after the 24th. Noticed the small bat flying about on several mild evenings. RUGBY SCHOOL.—Mean height of barometer for January 30·155 inches, (corrected for temperature and sea level.) Highest reading, (corrected,) 30·655 inches, on the 12th. Lowest reading, (corrected,) 29·424 inches, on the 25th. BICKENHILL VICARAGE.—A damp month, with hard frost on last three days. Heavy gale on 20th to 22nd. BRAMPTON S. THOMAS.—Temperature above the average. Rainfall about the mean for the last ten years. Snow fell on three days, but to no great depth. Gale on the 25th. Wild honeysuckle in leaf on the 4th. BUXTON.—Dull heavy weather prevailed in earlier part of the month, and was succeeded by slight falls of snow. Thunder and lightning on evening of 23rd, followed by snow and frost. BELPER.—Mean temperature on month was 39·3°. LINACRE RESERVOIRS.—Rainfall about the average, but only half the fall of January, 1877. STUFFYNWOOD HALL.—First half of month was mild. Snow on 22nd to 28th. Westerly gale on 21st. SPONDON.—An unusually dull and damp month, with little sunshine. WORKSOP.—Warm until the 23rd. Snow fell on 24th. High winds on 15th and 16th, and 20th to 23rd. SYSTON.—Rainfall below the average, and just half that of January, 1877. KIBWORTH.—Rainfall below the average, but remarkable for the many days on which some fell. WALTHAM-LE-WOLD.—Very mild and open until the last week. MARKET HARBOROUGH.—Dense fog on 18th. High winds 20th to 24th. Snow on 24th. ASHBY MAGNA.—Extremely mild month, except the last week. COSTON RECTORY.—Aconite in flower on the 5th. Snow on 10th and 25th. Gale on 20th and 21st. BELVOIR CASTLE.—Temperature above the average. S. and S.W. winds on fifteen days; N. and N.W. winds on fifteen days. Vegetation was active during the greater part of the month. Violets, primroses, and daisies were in bloom, and Aconite blossomed on the third week. Rather sharp hoar-frost on the three last days of the month; ice two inches in thickness formed. CASTLE ASHBY.—Rainfall unusually small for January. The average of the last five years is 2·42in. for this month. SEDGEBROOKE.—Snow 23rd to 25th. Westerly winds prevailed. CROYLAND ABBEY.—Snow on 24th. BURLEY-ON-THE-HILL. —Mild and fine till 21st. Snow 26th to 28th. RADCLIFFE OBSERVATORY.—Drizzle or fog throughont the month. Snow fell on 10th and 25th, and sleet on 8th and 23rd. VENTNOR.—Sea fogs on two or three days early in month. Barometer unusually high; reached 30·616 (uncorrected.) Slight fall of snow on 25th. ALTARNUN VICARAGE, CORNWALL.—The driest January but one (1876) in fourteen years, in consequence of prevailing N. and E. winds. Sharp frost 9th to 12th, and for last week of month.

A PRODUCTIVE POND.

At the recent conversazione of the Birmingham and Midland Institute, one of my correspondents, to whom I had sent some *Melicerta ringens* from here, introduced himself to me, and incidentally mentioned that he had found *Conochilus volvox* very abundant in a pond near Redditch. (See his letter, S.S.R., Redditch, in "Midland Naturalist," page 50.) As I had only seen this interesting rotifer once before, (at a *soirée* of the Quekett Club,) nor ever heard of its having been found in this neighbourhood previously, I gladly made an appointment to visit the pond, which I did on the following Saturday. I was much pleased on the first dip to find many specimens in my bottle, and I hastened, as time pressed, to carry home as many as possible. Of these I sent a bottle, containing nine groups, to a correspondent at Croydon, (a twenty-four hours' post,) of which only two groups survived the shaking of the journey, the individual rotifers, of which the groups consist, being so easily separated. After this I found my stock very rapidly disappeared, owing, (I attributed) to the number of larvæ and entomostraca which I had imprudently allowed to remain with the rotifers, and I, therefore, decided to pay another visit to Redditch. This time, as I was carefully examining the water at the pond side, I found a number of *Melicerta* on the duck-weed, of which I brought home a small quantity to my friend's house. It was a surprise to him, as he had, up to that time, overlooked it. As soon as he recognised the object, by the aid of his pocket lens, he called my attention to the large size of the pellets, of which the cases were built up. On reaching home I put the *Melicerta* under my compound microscope, and was surprised to see how marked a difference there was in the size and shape of the pellets as compared with those of the *Melicerta* I find in the pool here. The pellets of the latter have, where they project from the exterior of the case, a nearly hemispherical surface, whereas those of the specimens from Redditch appear to cover the case with small cones, nearly of the shape of sugar loaves; and on further examination I also see a great difference in the shape of the pellet cup, quite equivalent to the different shape of the pellets. I cannot help thinking this is a variety of *Melicerta* distinct from the one I have usually found. I have sent specimens to F. A. Bedwell, Esq., and to Dr. Hudson, for their opinion. Further examination of the duck-weed, from Redditch, showed me that it abounded with another rotifer I had never found before, *Cephalosiphon limnias*, figured by Dr. Hudson in the October, 1875, number of the "Monthly Microscopical Journal;" and curiously enough I also found a single specimen of what I call *Chætospira cylindrica*, which he figures in the same plate as *Archimedea (Chætospira?) remex*, and which he had found associated on the same weed *(Anacharis)* with the *Cephalosiphon limnias*. This infusorian I found here (the Hyde Pool) in August, 1872, on *Myriophyllum*, and it was named by Mr. W. Saville Kent, to whom I sent specimens, *Chætospira cylindrica*. I still further found on this duck weed, amongst other infusoria, many specimens of *Vaginicola decumbens* and *Epistylis natans*. Subsequently I found three *Tardigrada*, or water bears, diligently creeping about, and tugging away at the decaying portions of the *Lemna*. I cannot help saying I have seldom come across a locality of better promise to a naturalist taking any interest in pond life.—Thomas Bolton, Hyde House, Stourbridge.

A WINTER'S RAMBLE.

BY THE REV. JOHN CASWELL.

I have thought that it would prove interesting to put before the readers of the MIDLAND NATURALIST, and especially those who are fond of Botany, the results of a ramble in the neighbourhood of Birmingham during the first week of the new year. Several paragraphs had appeared in the newspapers of that week, calling attention to the fact that primroses and violets were already in flower. I notice also that a correspondent (E. W. B.) in the February number of the magazine gives a list of flowers gathered from his garden on Christmas-day last. The mildness of the present winter naturally led us to expect that the winter and early spring flowers would blossom sooner than usual; and, therefore, one was not altogether surprised to hear of primroses and violets having already appeared. But the addition given by E. W. B. is one worthy of notice, as it is evidence not only of a mild winter, but of a very mild autumn also; otherwise, such flowers as roses, stocks, mignonette, &c., would not be in blossom at this season of the year, as in the nature of things they are killed by the frosts and cold nights which usually characterise the autumn season. I therefore venture to add to the lists already given the plants I found in flower during the first week of January last. For some years I have made a ramble during that particular week, and always in the same locality, in order to note what plants were in bloom, as a record of the mildness or severity of the autumn and winter seasons, and for other reasons. Whilst in preceding years I have not found on an average more than twelve plants in flower in the district to which I limited my survey, this year I have recorded upwards of eighty British wild flowers, besides an unusually large number of garden flowers. The following is the list:—

Caltha palustris.
Helleborus fœtidus.
Capsella Bursa-pastoris.
Draba verna.
Cardamine hirsuta.
Barbarea vulgaris.
Sisymbrium officinale.
Cheiranthus Cheiri.
Sinapis arvensis.
Viola odorata.
Viola tricolor.
Lychnis vespertina.
Sagina procumbens.
Stellaria media.
Stellaria graminea.
Arenaria trinervis.
Cerastium viscosum.
Cerastium vulgatum.
Geranium sanguineum.
Geranium molle.
Geranium Robertianum.
Ulex Europæus.
Ulex nanus.
Viola hirsuta.
Geum urbanum.
Alchemilla arvensis.
Spergula arvensis.
Sedum reflexum.
Chærophyllum temulentum.
Hedera Helix.
Galium aparine.
Sonchus oleraceus.
Crepis virens.
Leontodon Taraxacum.
Lapsana communis.
Carduus nutans.
Senecio vulgaris.
Bellis perennis.
Chrysanthemum Leucanthemum.
Matricaria Parthenium.
Matricaria inodora.
Anthemis nobilis.
Arbutus Unedo.
Ilex aquifolium.
Myosotis collina.
Veronica hederæfolia.
Veronica Buxbaumii.
Veronica agrestis.
Teucrium Scorodonia.
Ballota nigra.
Lamium album.
Lamium purpureum.
Lamium amplexicaule.
Primula vulgaris.
Armeria maritima, (in gardens.)
Plantago major.
Plantago Coronopus.
Polygonum aviculare.
Euphorbia Peplus.
Euphorbia helioscopia.
Buxus sempervirens.
Urtica urens.
Galanthus nivalis.
Luzula campestris.
Calluna vulgaris.
Erica cinerea.
Spergularia rubra.
Daphne mezereon.
Scleranthus annuus.

In addition to these, I have found several species of Rubus, Rumex, Cyperaceæ, Juncaceæ, and Gramineæ. This list will, I dare say, cause surprise to some, and perhaps doubt; but in all cases, except one or two, the specimens I gathered were very good ones, and would not have disgraced any collector's herbarium. I have not included plants found in bud, though I have taken a note of them, nor those in fruit, whose petals had evidently just fallen; but only those actually in blossom. I found them all within a few miles of Birmingham. I had not the opportunity to wander through Sutton Park, or doubtless some

few others would have been added. Many of the localities where these plants were gathered are in exposed situations, and therefore one would have imagined it useless to look for them; and when we remember that in the Christmas week there had been several nights of sharp frost, and snow had fallen also, it is all the more surprising that so many different specimens should have been found. I am somewhat astonished that no list has appeared from the Southern Counties, which are so much warmer than our own Midland Counties; for, judging from a letter received from a friend in Devonshire, I should suppose that most of the summer flowers are still in bloom. He compares the Christmas week there to the Australian Christmas, and says that he gathered wild strawberries (*Fragaria vesca*) in abundance on Christmas-day. He also mentions that two nests with eggs had been found—the one a thrush's, the other a hedge-sparrow's. All these facts are certainly very interesting, and point to a most exceptionally mild winter.

Of the foregoing list some are plants that flower at this season of the year, and a mild winter only accelerates their flowering; some few others may be seen in flower all the year through; but by far the greater number are, so far as the experience of the last ten years allows me to speak, strangers to the late part of the autumn, and certainly to the winter. There are several absent that I have recorded in other years, such as *Ranunculus acris* and *R. sceleratus*, *Stellaria uliginosa*, *Erica Tetralix*, *Lychnis diurna*, *Nepeta Glechoma*, *Senecio Jacobæa*, *&c.*, and, strange to say, I did not find *Potentilla Fragariastrum*, a very early little flower. Neither did I find *Tussilago Farfara*. The mild weather still continues, and I notice that the hazel and willow are blossoming, and the hawthorn leaves already appearing. Doubtless others of your correspondents can add a few more to the list I have given. I think the record would be worth the while; for careful observation may enable us, in course of time, to ascertain with something like accuracy in what manner and to what degree plants are affected by the weather. So far we notice that, whilst certain plants live through the autumn into the winter, under certain conditions of weather, others, that appear much hardier, do not; whilst, for example, *Ranunculus acris* or *Centaurea nigra* will be found sometimes in January, after a severe and cold autumn, yet when the latter season has been mild, and the winter also, they are not to be found.—St. Mary's College, Oscott, February 18th, 1878.

Correspondence.

Organised Work for Natural History Societies.—The existence of "The Midland Union of Natural History Societies" is a matter for congratulation. The desultory efforts and resultless labours of many students might possibly be directed and utilised to good purpose if the Council would undertake the work of organisation. May I suggest that one part of the duties of that body should be to draw out a scheme for combined labours? Why should not the "Midland Naturalist" publish from time to time the results of the systematised labours of the naturalists of central England? Why should not all the Societies in the Union be engaged in preparing for this purpose, and under the direction of a competent committee, a complete account of the flora, fauna, and geology of the Midland Counties? The work would be arduous and not easily done; but a proper division of labour, working within definite lines, for well-considered purposes, would find excellent occupation for many of

our members, free from the charge of desultoriness. I feel sure this suggestion deserves thoughtful consideration, and I hope the Editors will invite communications, offering suggestions, from their many readers.—F. T. L. [We *do* invite such communications, and think F. T. L.'s remarks most valuable.—Eds. M. N.]

Freshwater Life.—Allow me as a subscriber to your journal to ask S. S. R., of Redditch, and other naturalists privileged to live near Midland ponds with such inhabitants as he describes, to help me to specimens. I will send bottles and pay all expenses with pleasure. But I live here in a district covered with glacial clay, which seems inimical to rotifer life. A paper of mine on *Melicerta ringens*, published in the "Monthly Microscopical Journal" for December last, brought me one of Mr. Bolton's (of Stourbridge) delightful little bottles. He still assists me, but I should be glad of extended help. To any gentleman who takes an interest in the subject, I shall be happy to send a copy of my paper on *M. ringens*. It may serve as lines to work on.—F. A. Bedwell, Fort Hall, Bridlington Quay, Yorks.

The Meaning of Knowledge.—I think Mr. Mott has unduly limited the meaning of the word knowledge. The verb "to know" is used to express two classes of cognition for which in many other languages two distinct verbs are used. Thus, we have in French *connaitre* and *savoir*, in German *kennen* and *wissen*, in Latin *novi* and *scio*. The first words of each of these pairs are used for knowledge acquired by means of the senses, and thus correspond nearly to the English "to be acquainted with" or "aware of;" whilst the others are used for knowledge obtained by the reasoning faculties, and signifies to comprehend or to know thoroughly.—C. J. Watson.

Accuracy in the Use of Scientific Terms.—It is necessary to say a few words in reply to your correspondent, although it is hardly possible to imagine that any student in Botany would, for one moment, suppose there could be anything animal-like (except in the one respect) in the two distinct existences of the same plant being likened to the two existences of an insect, (the caterpillar or butterfly.) Care was also taken to explain the exact meaning of the terms used. Animals and plants copy each other—some in one particular and some in another. The sea-anemone is an animal, and only takes its name from its resemblance (in one respect) to a plant. No one would think of confusing the Bee Orchis or the Butterfly Orchid with a Bee or a Butterfly; the Sun-flower, Moonwort, or Windflower, with the Sun, Moon, or Wind; the Hare's-foot fern or Stag's-horn fern, with a Hare or a Stag; the Cats-tail, Dog-rose, Bull-rush, or Horseradish, with a Cat, Dog, Bull, or Horse. The Oak-fern does not bear acorns, nor the Holly-fern berries, nor the Beech-fern nuts. We might, also, enumerate Lady's-slipper, Harebell, Buttercup, Cowslip, Snowdrop, Iceplant, and many others. Perhaps it would have been better to have described these two distinct generations of fern life as—1st, the prothallium-state, and 2nd, the perfect-fern—the first as *sexual* and the second as *asexual*. With regard to the remaining passages, "the spiral filaments swarmed about the pistillidium in numbers," "these filaments being tossed into the air, and by landing in certain cups are said to fertilise the plant," and "these, from their activity, are called Animalcules;" they are the expressions used by Count Suminski and Mercklin, and have been copied and used by such authorities as Henfrey, Moore, &c., and therefore may again be used with impunity.—E. J. Lowe.

Preservation of Fungi for the Herbarium.—Would some of your readers kindly describe the best methods of preserving fungi?—C.T.M.

Entomological Club.—A London correspondent writes to us as follows:—"At a meeting held at the house of Dr. E. Hart Vinen, F.L.S., on the 30th January, Dr. Cobbold, F.R.S., communicated a notice of an interesting discovery made by Dr. Manson, at Amoy, China. It appears that the mosquito *(Culex)* forms the intermediate host of the *Filaria sanguinis hominis*, or microscopic filariæ living in human blood (hæmatozoa.) In the course of the evening it was stated that most of the worms found in insects were imperfectly developed entozoa. Filariæ from three to five inches in length had frequently been noticed in dermaptera and coleoptera; especially in *Forficula*, *Phosphuga*, and *Feronia*. Dr. Cobbold exhibited adult human Filariæ, *(F. Bancrofti,)* from Australia, and also a beetle, *(Passalus cornutus,)* known to be infested with a species of Ascaris in the mature state *(A. infecta.)* Many of the entomologists of the Metropolis were present at the meeting (Messrs. Pascoe, Dallas, Smith, Sheppard, Grut, and Stevens.) Other well known naturalists, including Drs. Murie and Ord, took part in the discussion. Dr. Vinen (whose fernery proved a great attraction to the botanists present) remarked, in the course of his observations, that notwithstanding the great age of the Club it exhibited no signs of decay."

Mosses.—A warm interest in these lovely plants has been created in my mind, from having had my attention recently awakened to their variety and great beauty by the sight of a collection made by a local botanist many years ago. I am quite amazed at their numbers and their individual beauty. I must confess an almost entire ignorance about them; but I am really most anxious to have my ignorance displaced by knowledge. Will one of the bryological readers of the "Midland Naturalist" do me and others, who may desire the information—I am sure there must be many such—a great kindness by writing a paper pointing out what steps we should take, and what books consult, in order to be able to discriminate the various English mosses. The instructions, to be really useful to myself, should commence at the very beginning. I sincerely hope some qualified botanist will undertake this labour of love, and that room for such paper may be provided by the Editors.—M. B. L., Coventry. [Our correspondent will see that his desires have been anticipated, and that our present number contains the first of a series of elementary papers on the study of the mosses.—Eds. M. N.]

A Curious Case of "Reparation."—Last November I was fishing in one of the pools on the border of Sutton Park, and caught a small pike weighing between two and three pounds. On getting him into the punt I noticed a singular hump on the back just in front of the dorsal fin. I took him home, and my doctor looking in next morning I asked him to examine into the cause. On laying bare the back bone we found that at some time or other, but not very recently, the bone had been absolutely severed, probably by a bite from another fish, and that a new formation of bone had taken place, thus slightly lengthening the spine, and forming a slight hump. Of course the spinal cord was not broken when the injury was inflicted, or the fish could not have survived. I am aware this is not an isolated case, as one if not two previous instances of a similar kind have occurred, but as it is certainly very rare it seems worth recording. The fish appeared to have been in no degree affected by the hump as to liveliness or strength. I had the portion of bone showing the abnormal growth cleaned, and presented it to Mr. Montagu Browne, Naturalist, Broad Street, Birmingham, who will, no doubt, be willing to show it to anyone interested.—Wm. Taylor, Edgbaston.

Preserving Fish.—A description of the best methods of preserving fish in a natural state for the cabinet, particularly fresh-water kinds, is much desired by an amateur collector.—T., Nottingham.

Magpie and Cuckoo.—The fact recorded by the Rev. O. M. Feilden as to the nesting of the Magpie is extraordinary, but requires more evidence ere we can accept as proved that which may have been evolved from a fortuitous chain of circumstances. Concerning the question as to that feathered mystery, the Cuckoo, it will I think have come under the notice of every observer, as of myself, that now and then a Cuckoo's egg is found under circumstances—such as in a nest situated in a brushwood stack—which positively forbid the hypothesis that it could have been laid in the ordinary manner. In the *Field* of July 1st, 1876, an account is given of the finding of a Cuckoo's egg in a Flycatcher's nest in a hollow tree, the orifice being too small to admit the entrance of any bird so large as a Cuckoo. Again the same paper of July 15th, 1876, notices the discovery of a young Cuckoo in a Wren's nest, situated on the rafters of a shed, in such a position as to prevent the ingress of a bird any larger than its foster mother. That the Cuckoo must occasionally lay its egg first and then carry it in its bill, is, I think, partly proven by the foregoing instances, even without the testimony of a traveller—Le Vaillant (?) I think—who actually shot a South African Cuckoo in the act of carrying its egg in its bill. Morris and other authors mention—on apparently good authority—that the European Cuckoo (*Cuculus canorus L.*) also has been shot in the act of carrying its egg, and if so does not this prove the possibility of the introduction of the egg by the bill into nests difficult of access? Howbeit, the subject is one infinitely interesting, and well worthy of being worked out in the coming spring by the ornithological readers of the "Midland Naturalist."—A. M. B., Birmingham.

Gleanings.

The Wollaston Gold Medal of the Geological Society has just been awarded to Dr. Thomas Wright, F.R.S.E., F.G.S., &c., President of the Cheltenham Natural Science Society, (one of the societies forming the Midland Union of Natural History Societies,) in recognition of his detailed researches, continued for many years, on the structure, classification, and distribution of the *Fossil Echinodermata*, published by the Palæontographical Society, and for his other "Memoirs on the Jurassic and Tertiary Strata of England," contributed to the Geological and other kindred societies.

Professor Fries, of the University of Upsala, the well-known Swedish Botanist, died recently at the age of 83.

The Rev. Andrew Bloxam, M.A., Rector of Harborough Magna, died, we regret to have to record, on February 2nd, in his 77th year. He was one of the best botanists Warwickshire has produced. In an early number we purpose giving a memoir of his life and some account of his labours as a Naturalist.

The late Andrew Murray, F.L.S., has, for some years past, been known as a hard-working Entomologist, engaged in investigating the injury done to field and garden crops by insects. The tiller of the soil has not known how to meet his insect foes, and has even confounded friends with foes by not knowing the metamorphic phases through which insects pass. Connected officially with the Royal Horticultural Society, to whose scientific committee questions respecting damage to crops are often referred, Mr. Murray was so impressed with the general ignorance of insect life that he made suggestions to the Privy Council which led to the formation of a collection of economic entomology, under the direction of the Science and Art Department. This collection, now for

some time past at the Bethnal Green Branch Museum, was intended by Mr. Murray as a type museum for instruction in agricultural districts. Its formation had occupied the greater part of his energies for years past, and his last few days at work were devoted to its completion. He died on the 9th January.

Thomas Vernon Wollaston.—This well known Entomologist died on the 4th inst., at his residence, Teignmouth. We copy the following from *Nature* :—"To students of British Entomology, Mr. Wollaston is best known by his early papers in the *Zoologist* and Stainton's *Entomologists' Annual and Weekly Intelligencer*, and by his revision of *Atomaria* in *Transactions of the Entomological Society*, 1877. He published many descriptive and analytical papers, almost exclusively on *Coleoptera*, in the above-named publications, the *Journal of Entomology*, and the *Entomologists' Monthly Magazine* ; but his *magnum opus* is the well-known 'Insecta Maderensia,' published in 1854, the results of his sojourns in Madeira, to which he first went in 1847. The acquisition of fresh material compelled him to write his 'Coleoptera Atlantidum,' an arduous, critical work of nearly 700 pages, followed in 1867 by the 'Coleoptera Hesperidum,' a valuable descriptive account of the species of the Cape Verde Archipelago, visited in 1866. His last contribution to geographical entomology, 'Coleoptera Sanctæ-Helenæ,' 1877, contains a multiplicity of unexpected developments."

Leicestershire Flora.—Many years ago Mr. T. R. Potter, of Wymeswold, projected a New History of Leicestershire. For this work the late Rev. Andrew Bloxam prepared and supplied to Mr. Potter a copious list of wild plants found in Leicestershire. The history was never issued, and it is unknown what became of Mr. Bloxam's MS. Was it sold, with other papers, after Mr. Potter's death? If so, to whom, and who is now the possessor of the papers? Any information on the subject communicated to the Editors of this magazine will be gladly received.

Aquaria.—It may be interesting to some of our readers to know that Mr. W. A. Lloyd, of the Crystal Palace Aquarium, is not only engaged in preparing the volume to which we referred on page 54, but is also writing a series of very plain and clear articles (which will probably extend to eight or ten) on the management of Aquaria for the *Englishwoman's Domestic Magazine*, (Ward and Lock.) The first appeared in the number for December last, and the second in the February number. The articles, though written mainly for the use of ladies, are, of course, equally adapted to anyone who may be desirous of understanding the how, why, and wherefore of Aquarium management.

West London Entomological Society.—At the weekly meeting of this society, on February 8th, Mr. J. Smith exhibited a very extraordinary variety of *L. conigera*, showing all the markings and colour of the upper wing on the left under wing, particularly the white central spot, which made it appear as if the under wing had been folded up on the upper one and taken the exact impression. It was taken at the Welsh Harp, near London, 1876, by the exhibitor.

Phenological Observations.—The Rev. T. A. Preston read an interesting paper on this subject before the Meteorological Society on December 19th, 1877. He stated that the order of flowering had been the same in 1877 as in 1876. Plants begin to flower first in the south-west of England, and thence in gradation up to the north of Lincolnshire. Damp appears to act more powerfully than cold in retarding the flowering of some plants. The year 1877 was an unfavourable one for vegetation generally. The bitter cold of May checked the growth of plants, and by the autumn there was little new wood, and that not properly ripened.

All observers who desire to aid in this interesting work should obtain the "Instructions for the Observation of Phenological Phenomena," (Williams and Strahan, price 6d.,) drawn up by Mr. Preston, which contains lists of Plants, Insects, and Birds to be observed, together with Rules, Approximate Dates, Remarks, &c.

FOSSIL INSECTS.—At the meeting of the Geologists' Association on January 4th, Mr. H. Goss read a paper on the fossil insects of the secondary period. Mr. Goss pointed out that nearly all the British specimens known are from the Purbeck beds and from the Lias. Some few have been found in the Wealden, and a few elytra of Coleoptera were recorded from the Kimmeridge clay, the forest marble, and the great oolite. Nearly all the other European specimens are from the Solenhofen slate of Bavaria, or from the Swiss Alps. The paper was a lengthy one and rich in detail, and will appear in the proceedings of the Association.

OUR UNION.—"The Birmingham and Midland Institute Scientific Society," "The Cheltenham Natural Science Society," and the "Evesham Field Naturalists' Club" have joined the Midland Union of Natural History Societies during the past month. The Union now includes twenty Societies. Societies which have not yet joined are invited to do so.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—GENERAL MEETING, January 29th.—Mr. W. B. Latham read a paper on "Orchidaceæ, British and Exotic," in which he dwelt at some length on the treatment Orchids require under cultivation, their various kinds of inflorescence, habits, modes of fertilisation, &c. The paper was illustrated by diagrams and living plants. Mr. W. B. Grove, B.A., exhibited fronds of a fern, supposed to be a hybrid between *Blechnum corcovadense* and *Lomaria gibba*. ANNUAL MEETING, February 5th.—The President, (Mr. Edmund Tonks, B.C.L.,) in the chair. The report gave an encouraging account of the present state of the society. There are 266 members, being an increase of thirty-one during the year. The report and treasurer's statement of accounts were unanimously adopted. Mr. Tonks was re-elected president, Mr. Walter Graham and Mr. Edward W. Badger were elected vice-presidents. The following re-elections were also made:—Mr. Charles Pumphrey, treasurer; Mr. John Morley, secretary; Mr. James E. Bagnall, librarian; Mr. W. H. Cox and Mr. J. Levick, curators. BIOLOGICAL SECTION, February 12th.—Mr. W. R. Hughes, F.L.S., was elected chairman of the section, and Mr. A. W. Wills secretary for the ensuing year. Mr. J. Bagnall exhibited, on behalf of Mr. C. T. Parsons, an abnormal form of *Lentinus lepidus*; for Mr. Joseph Bragg a fasciated stem of common holly *(Ilex;)* collected by himself, a fasciated state of *Picris hieracioides*, also a remarkable instance of phyllody in all parts of raceme and flowers of Foxglove *(Digitalis.)* Mr. Edmund Tonks exhibited and described a fine specimen, in good fruit, of the Gulf-weed *(Fucus natans.)* Mr. J. Bagnall exhibited, on behalf of Mr. Joseph Cotton, fine specimens of the seventeen year Cicada, *(Cicada septendecim,)* and read an interesting account of them, sent by Mr. J. F. Weston. Mr. John Morley exhibited, and gave a series of notes upon, a variety of *Scolopendrium vulgare*, var. *variabile*. A discussion on the hybridisation of ferns followed. Mr. Slatter exhibited a slide of *Nostoc verrucosum*. A vote of condolence with the widow of the Rev. A. Bloxam, of Harborough Magna, was unanimously passed.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY.—January 30th.—Mr. W. G. Fretton read a paper on "The Artisan, his Recreations and Hobbies." Mr. Fretton mentioned several artisans who, by steadfastly cultivating their hobbies, had become respectively celebrated ornithologists, botanists, geologists, and proficients in mechanical arts. February 13th.—Mr. T. F. Webb read a paper on "Electro-deposition."

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.—NATURAL SCIENCE SECTION.—January 9th.—Mr. J. Burton, F.R.M.S., read a paper on "Monads." The paper was based on the researches of Dallinger and Drysdale, and treated of the life history of several of these "forms" or genera. January 16th.—A paper on "Teredos or Wood-boring Mollusca," was read by Mr. B. Sturges Dodd, (and not as erroneously stated, p. 27, on December 19th, 1877.) January 23rd.—A paper was read by the Hon. Sec., Mr. I. Mosley, on "The Geological Structure of Derbyshire," illustrated by maps, sections, fossils, and rock specimens. January 30th.—General Microscopical Meeting.—The President of the Section, Mr. Edwin Smith, M.A., gave an interesting account of the construction and management of the microscope. Numerous objects were viewed under microscopes. February 20th.—Mr. E. Smith, M.A., read a paper on "The Geology of the Isle of Wight," which was illustrated by lantern views.

NOTTINGHAM NATURALISTS' SOCIETY.—February 6th.—"Notes on Collecting and Preserving Natural History Objects," by Messrs. C. Musson and L. Lee, illustrated by mounted specimens. February 13.—Microscopical Evening. Lecture on "Stomata; their forms and use," by Mr. L. Lee.

RUGBY SCHOOL NATURAL HISTORY SOCIETY.—February 9th.—First meeting this term. Mr. G. Jones, School House, was elected secretary. A practical paper on "Pupa-digging" was read by Mr. J. Lea, in which some of the ordinary maxims of the art were criticised in the light of practical experience. A paper was also read on "Humming Birds," illustrated by sketches. The Rev. T. N. Hutchinson exhibited the Telephone, giving a short explanation of the principle. Those present then tested the instrument by experiments, which were completely successful.

SEVERN VALLEY NATURALISTS' FIELD CLUB.—February 19th.—The annual winter meeting was held at Bridgnorth. The following officers were appointed for 1878:—President, Mr. T. Martin Southwell; Vice-Presidents, the Rev. F. A. Mather, Mr. R. H. Colley, Mr. J. G. P. Smith, Mr. A. Mathias; Honorary Secretary, Mr. Rowland W. Ralph. The following Field Meetings were fixed:—Malvern, June 4th, 5th, and 6th; Hawkestone, July 2nd; Ellesmere or Welshpool, August 6th. A beautiful collection of New Zealand ferns was exhibited by Mr. Southwell.

TAMWORTH NATURAL HISTORY, GEOLOGICAL, AND ANTIQUARIAN SOCIETY.—February 4th.—Mr. W. Wright Wilson, F.L.S., M.R.C.S., delivered a lecture on "Light, its Sources and Effects," illustrated by well-executed diagrams. Interesting experiments were shown in connection with the lecture by Monsieur Morand.

Notices to Correspondents.

Communications received from S. L. M., Huddersfield, (thanks;) T. P., Stroud, (will appear in next number;) C., Nottingham, (anonymous communications not admissible.)

We have several articles and letters in type, which for want of space we are obliged to hold over till next month.

Copies of our prospectus, containing lists of contents of "Midland Naturalist" for January, February, and March, will be sent to any of our readers who will kindly undertake to distribute them among friends likely to become subscribers.

Notes on any Natural History subject are invited.

Communications, authenticated by name and address, should reach us before the 18th of the current month, and be addressed the Editors of the "Midland Naturalist," *Midland Counties Herald Office*, Birmingham.

THE BIRMINGHAM AQUARIUM.

BY W. P. MARSHALL, ESQ., M.I.C.E.

The first step towards the attainment of this desirable object (now about to be realised) was the appointment of a Committee of the Birmingham Natural History and Microscopical Society four years ago, to obtain information on the subject, with the view of promoting an efficient Marine Aquarium in Birmingham; the subject having been introduced by the President, Mr. W. R. Hughes, in an address at the annual soirée of the Society. This Committee, after procuring information from different Aquaria in this country and on the continent, sent a deputation to visit and examine the Crystal Palace Aquarium and the Brighton Aquarium, for the purpose of obtaining practical information about the requirements to be provided for, and specially to enquire into the two different systems of circulation and aeration of the water that are carried out at those places and the results of their working.

In the Crystal Palace Aquarium a constant circulation of the water is maintained night and day throughout the series of tanks, in connection with a large reserve of water in the store tanks, amounting to five times the contents of the show tanks; and the aeration is effected by means of small jets of water under considerable pressure, which are discharged into the top of each tank, and carry down mixed with the water of the jets a quantity of air, which is discharged in the form of countless myriads of bubbles, so minute that they float a long time about the body of the water in the tanks before rising to the surface, and thus present an enormous oxidising surface to the water; and, as a result, the whole mass has a bright, sparkling, almost effervescent appearance. In the Brighton Aquarium the aeration is effected by pumping air into the tanks through pipes of considerable size, from which the air issues in large bubbles that rise quickly to the surface; there is not any actual circulation of the water from one tank to another, and the quantity of water in the reserve tanks bears only a small proportion to that in the show tanks; the water can, however, be renewed, by pumping from the sea, but in consequence of the supply being taken from near the shore the water is exposed to mixture with sand and other detritus, and requires some time to become clear. In the Crystal Palace Aquarium the original supply of sea water for the tanks continues in use, and does not require any renewal, except to replace unavoidable waste, all that is needed being the addition from time to time of a small quantity of fresh water to compensate for the gradual loss that takes place from evaporation; the supply of sea water in the store tanks—which are kept in the dark to counteract the tendency to vegetable growth in the water—is so much greater in quantity than the contents of the show tanks, that the water after circulating through them becomes thoroughly restored to a fresh and healthy condition before returning to the show tanks in the course of the circulation.

The result of the examination and enquiry of the Committee was a recommendation of the Crystal Palace system, (which is the plan of

Mr. Lloyd, the Manager of that Aquarium,) in consequence of their finding the Brighton Aquarium not so successful, zoologically considered, as to the health and condition of the animals, and the clearness of the water in the tanks. The Crystal Palace Aquarium was found to be eminently successful in these respects, the most delicate animals being maintained in perfect health and almost free from those parasitic growths to which they are so subject in confinement, whilst the water in the tanks was beautifully transparent and brilliant. The action of the Committee resulted in a proposal to construct an Aquarium in the basement story of the Midland Institute Building, facing the Town Hall, and plans were prepared by the writer for this purpose under the advice of Mr. Lloyd, who was called in to examine and reported favourably upon the proposal. That proposal, however, had ultimately to be given up, in consequence of it being found impracticable to adapt the existing building satisfactorily for the desired object. The idea in this proposal had been to establish a Public Aquarium pure and simple, with appliances for scientific study and instruction, in close connection with the Public Library and Art Gallery, and supported only by a small admission charge; the original cost of construction being intended to be materially reduced by the circumstance of adapting a portion of an existing building and thus avoiding the cost of erecting a new building.

It was strongly felt to be a very desirable thing for a Birmingham Aquarium to be established, and that the situation of Birmingham, in the centre of the country, far removed from any sea-coast, would cause a Marine Aquarium to be a special attraction there, and that it would be both a source of great pleasure, and an object of elevating character for the large population not only of the town, but also of the "Black Country" neighbourhood, who may be said to have a decided turn for Natural History objects as regards animals, birds, and cottage gardens. The Marine Aquarium, (as remarked by Mr. Hughes in a subsequent paper read before the Natural History Society,) "appeals to the two extremes of society—to the unlettered, who look with wonder and curiosity on strangeness of form and beauty of colour, and to the cultivated, who, from a higher point, regard with profound interest details of structure and affinities and analogies with beings of other times. No greater attraction, or means of intellectual recreation for the working classes of the town and neighbouring mining districts could be devised, because it would be so utterly different from any other existing exhibition, and so suitable as a relief and mental refreshment for those in crowded courts, to whom the sea, with its living wonders, is but a name. No cabinet collection of dried specimens can bring to view such instances, among a thousand others, as the graceful progress of the flat-fishes, or the weird form and muscular contractions of the Cuttle-fish; no picture can rival in colour the markings of the Wrasse, or the living fire of the eyes of the Dragonet; no library can give the student such a clear idea of the inhabitants of the sea from mere description, as can the contemplation of the actual living beings themselves. As a utilitarian agency for the solution of undetermined points in biology, the Aquarium may, in some measure, help in arriving at a

solution of such problems as how to secure the proper development of and render available those almost innumerable germs of food supply that are produced by sea fishes in general. The Turbot, for instance, produces about fourteen millions of eggs annually, of which not one perhaps in ten thousand reaches maturity, nor one in a million finds its way to our tables. Our knowledge of the laws governing the movements—the appearance and disappearance in certain localities—of the Herring and other fishes, their spawning and time of development, is still obscure; and if we had light thrown upon this subject thousands of tons of valuable food would be available for us. These enquiries cannot be considered visionary, nor the results obtained from them unprofitable, when it is remembered that within the last few years of judicious legislation, the result of accurate knowledge obtained by these researches has so developed the Salmon fishery that, in place of this fish being only obtainable by the few and wealthy, it is now every season so cheap and abundant as to be found on the table of the artisan."

The idea of the Birmingham Aquarium was ultimately revived in a definite form by the late Mr. Arthur Ryland, (to whom the origination of the Midland Institute was also due,) and he succeeded in enlisting the support and co-operation of a number of influential gentlemen to a proposal, which led to the formation last year of a Limited Company for the construction of the Birmingham Aquarium. It was felt that an Aquarium alone could not be made to succeed financially, and it would require to be combined with some other attraction, such as first-class music, and must consequently involve the erection of a large building in some central situation. The great difficulty experienced was the obtaining a suitable site in a sufficiently central situation; but this has been now overcome in a highly satisfactory manner, by obtaining the site of the old Hen and Chickens Hotel, in New Street, (classic ground of the old coaching days,) which is a remarkably favourable situation for ready access of the public, in the principal thoroughfare of the town, and in close proximity to the two railway stations. The hotel will be converted into a first-class restaurant, the largest in the town, and in the rear will be built the Aquarium, with a spacious and convenient Concert Room above it, affording facilities for concerts that have been long felt to be much needed in the town.

The Aquarium will consist of a large, handsome Hall, upwards of 100 feet in length, with a series of tanks extending along each side, and forming the sides of the Hall, and amounting in total extent to about as much as those of the Crystal Palace Aquarium. There will also be an extensive series of table tanks; and in the rear a large and commodious space for the food and store tanks, the machinery, and the general working purposes of the Aquarium. The public approach will be from the present portico in New Street, through a large Entrance Hall, from which a handsome flight of steps will lead down to the Aquarium, which will be constructed of red terra-cotta, with the ceiling supported by arches resting on ornamental pillars. The large Assembly Room, on a level with the New Street entrance and over the Aquarium, will be 165 feet long, and will consist of three divisions—the first portion being appropriated

to the table tanks, the central transept for a similar purpose, and at the end will be the large Concert or Lecture Room, surrounded by galleries, and capable of holding 1,000 persons. The block of the present building facing New Street will be retained, and converted into a large Restaurant on the first floor, 70 feet long; and the kitchens will be at the top of the building, according to the most approved modern arrangement. Large shops and sets of retiring rooms will be arranged on each side of the New Street entrance; and means of exit in the rear into Worcester Street will be provided for the Aquarium and Concert Room. Mr. J. A. Chatwin, F.R.I.B.A., is the Architect, and the writer is the Engineer. The company have got possession of the site, and the building will be commenced at once.

THE REV. ANDREW BLOXAM: A MEMOIR.

BY THE REV. M. J. BERKELEY, M.A., F.L.S., ETC.

There is, perhaps, no country in which so much good work in Natural Science is done in a quiet and unpretending way as in our own. Many persons, scattered up and down the country, are making valuable observations, which are recorded by themselves or others, from time to time, without taking any prominent position in the scientific world. Such was the subject of the present notice, who, whether from modesty or the cares of tuition, did not take a place as a leading Naturalist, though he might well have done so from the good work he performed, and the numerous reports on various matters which he furnished to journals of more or less importance, though he has not left any great volume behind him to bear witness to his talents.

The Rev. Andrew Bloxam, late Incumbent of Twycross, Leicestershire, and, at the time of his death, on February 2nd, 1878, Rector of Great Harborough, was the fourth son of the Rev. Richard Rouse Bloxam, D.D., one of the Masters of Rugby. He was born at Rugby, on the 22nd of September, 1801, and was consequently in his 77th year at the time of his death. He entered at Rugby School in the year 1809, leaving for Worcester College, Oxford, in 1820, of which he ultimately became a Fellow. His father had a great taste for archæology, inherited from his relative Mr. Rowland Rouse, of Market Harborough, a taste which descended to his son Matthew Holbeche, the excellent author of "The Principles of Gothic Ecclesiastical Architecture," and other valuable antiquarian works. The author of this notice recollects, when a schoolboy, procuring for the father a drawing of the curious monument to the Loringe family in Oundle Church. Mr. Bloxam's mother was sister of the celebrated artist Sir Thomas Lawrence, and Mr. Purton, of Alcester, the author of "The Midland Flora," his uncle by marriage, so that there was talent and taste on all sides, and it would have been strange if, with these advantages, he had not inherited some good qualities. There were, moreover, circumstances which were highly in his favour. It has been

the practice to ignore all the good that was done at Rugby before the time of Dr. Arnold, but with great injustice. Dr. Wooll, though not a profound scholar, had great taste for literature, and encouraged it wherever he saw an opportunity of doing so. There was a small but well-selected library, which was much used by the upper boys. But this was not all. There were lectures on natural philosophy, which were extremely popular, and some of the boys were trying their hands at making air-pumps and electrical machines; there was also a course of comparative anatomy, which was extremely good, illustrated with well prepared specimens, and to these more than one were indebted for their first comprehensive views of physiology. The vicinity of the Lias pits at Newbold, and the diluvial gravel at Lawford, gave great opportunities for collecting fossils, some of which, after sixty years, the writer has now before him, and amongst the numerous collectors the subject of this memoir was not the least active. The specimens which he accumulated were utilised by Dr. Buckland, the late Dean of Westminster, in his "Reliquiæ Diluvianæ," and were ultimately presented to the Ashmolean Museum at Oxford.

In the autumn of 1824, having been offered the situation of Naturalist in the Blonde Frigate, (of which his eldest brother was Chaplain,) commanded by Captain Lord Byron, which was dispatched by Government to the Sandwich Islands to convey there the bodies of the King and Queen who had died in this country, he at once accepted it. During the voyage, which lasted eighteen months, he had the opportunity of visiting several places both on the eastern and western coasts of South America, and also numerous islands in the great Pacific Ocean, from which he brought home a large collection of objects of Natural History, amongst which were several, at that period, new to science, which, on his return in the year 1826, were deposited in the British Museum. He took Holy Orders a few months after his return, and for many years was located in a part of Leicestershire extremely favourable for natural research, where he had the pleasure of association with a very young but intelligent Botanist, now the honoured Professor Churchill Babington, who bade fair to be a shining light in the botanical world, but whose studies have since been diverted to classical and archæological literature, in which he has taken a very prominent position.

Mr. Bloxam's researches were not confined to any one department of Botany or Natural History. His communications on Conchology, Ornithology, Phænogamic and Cryptogamic plants, to leading periodicals were numerous; but, with the exception of his "Fasciculi of British Brambles," which have been appreciated highly by those who regard the greater part as mere forms of one, or perhaps, two species, as well as by those Botanists who look upon every form as distinct, his most useful work was amongst the Fungi, in which his neighbourhood was peculiarly rich. Many of the most interesting species have been recorded in the notices of British Fungi by Messrs. Berkeley and Broome in the "Annals of Natural History," and a very curious genus has been dedicated to him by the same authors. In conjunction with Mr. Churchill Babington he was enabled to furnish a very copious list of the Phænogamous plants

growing in Charnwood Forest and its precincts to Mr. T. R. Potter for his history of that district, and in conjunction with his friend, the Rev. W. H. Coleman, he contributed an admirable list to "Potter's History of Leicestershire," which unfortunately has not been published. These were much appreciated by Mr. Watson in his researches on the distribution of Phænogams in the British Isles. His communications were not, however, confined to Phænogams, and we have now before us a plate containing illustrations of two most interesting Agarics, *Agaricus Babingtonii* and *Agaricus Bloxami*, of which the latter is one of our most elegant species. It should not be passed by without notice, that in the appendix to the account of the Voyage of H.M.S. Blonde to the Sandwich Islands, published by Mr. Murray, Mr. Bloxam's notes on the Natural History of these islands will be read with much interest.

Though a very constant correspondence took place between the writer of this notice and Mr. Bloxam for some years, there were but two opportunities of personal communication: one in the Herbarium at Kew, and the other at Rugby, on the occasion of the consecration of the new Chapel, after he had left Twycross for Great Harborough. There were, however, many opportunities of having tidings of him, which were all of the most favourable character, showing how he was appreciated not only for his various talents and acquisition of valuable information which always made him a welcome guest, but for that kind and amiable disposition which at Rugby made him a favourite of all who were thrown into communication with him. There is a chalk drawing of him by his uncle, Sir Thomas Lawrence, which was taken in 1824, previous to his starting for the Sandwich Islands. A daguerreotype likeness was engraved for the contemplated History of Leicestershire, which was, however, never published. There is also a water-colour drawing by the late eminent painter, Turner, in the National Gallery, representing the group of the six brothers attending the funeral of their uncle, Sir T. Lawrence.

Mr. Bloxam married Ann, daughter of the Rev. John Roby, of Congerstone, in the county of Leicester, (a descendant of Nehemiah Grew, who in 1671 dedicated the first book of his "Anatomy of Plants" to the celebrated John Wilkins, Bishop of Chester,) and by her had a numerous family.

PROFESSOR EDWARD FORBES AND HIS COUNTRY.

BY ROBERT GARNER, F.L.S.

[*Continued from page 70.*]

The Maritime Flora is more ample in species than the Lowland or Upland, probably as rich as that of any portion of the British Isles of the same size. There are about 100 species of flowering shore-plants around our Islands, and more than sixty of these are found around the Isle

of Man; for instance, on the southern cliffs, about Peel Castle,* on the sands to the north of Ramsey,† and at Maughold,‡ remarkable also for its rock scenery, and for its antiquities. There is a deficiency, however, of some southern and south-eastern maritime species, as might be expected from climatal considerations, without reference to any geographical changes. But, confining ourselves to the inland, it will appear, upon the whole, that the Isle of Man, like other small isolated tracts of country, is rather limited in the number of its plants, and Forbes was led to philosophise on this point. There appears to be reason to suppose that the island was not isolated from Ireland till (geologically speaking) modern times, and he thought that this agreed with the extension to Man of certain (so-called) Lusitanian species, which he names, *Pinguicula lusitanica*, *Scirpus Savii*, &c.; and also that the absence of certain southern species, if it is not from climatal inadequacy, may likewise be set down to an analogous cause, the separation of the outer islands, whilst England still made part of the Continent, thus allowing such plants to extend themselves in it, but not further. As regards truly mountainous—or what is tantamount—northern species, the above absence or paucity holds good, but from another cause. In the main islands some of these have been supposed to have survived glacial times by their fixity on the summits of high mountains, elevation being tantamount to latitude and lower temperature. Perhaps the Manx hills were never very high, but, it may be, half submerged, and receiving their deposits of clays and drifts, whilst those of Scotland and Wales were the seats of glaciers.

With this floral deficiency it is rather interesting to observe how many plants, which are not truly indigenous, have escaped from ancient homesteads and gardens, and have become quite at home, as well as luxuriant; showing that islands and isolated places often grow in great perfection plants which are not native, when once introduced. Horticulturists are aware of this proclivity of the island. Such interlopers are the following:—*Spiræa salicifolia*, *Senecio saracenicus*, *Inula Helenium*, *Gnaphalium margaritaceum*, *Pyrethrum Balsamita*, *Balsamita vulgaris*,§ *Lavatera maritima*, *Antirrhinum Orontium*, *Reseda fruticulosa*, *Saponaria officinalis*, *Myrrhis odorata*, *Petroselinum sativum*, *Vinca major*, and, perhaps, other plants of a similar origin: The Irish arbutus, hydrangea, fuchsia, myrtle, ilex, euonymus, jasmine, escalonia, Buddleia, and tree-veronicas are very luxuriant in the open air. The cowslip appears to be absent,

* *Spergula maritima*, *Cerastium tetrandrum*, *Chenopodium murale*, *Arenaria marina*, *Hyoscyamus niger*. At the Stack of Scarlet, *Samolus Valerandi*, and *Œnanthe crocata*.

† *Salsola Kali*, *Ruscus aculeatus*, *Cakile maritima*, *Crambe maritima* *Glaux maritima*, *Convolvulus Soldanella*, and *Tamarix*.

‡ *Crithmum maritimum*, *Scilla verna*, *Silene maritima*, *Allium vineale*, and *Asplenium marinum*. After a storm, enormous fronds of *Laminaria bulbosa* *L. saccharina*, and *A. esculenta* are cast on the shore; these deep-water Fuci are most productive of iodine, which, however, can only be here manufactured to pay when the drug is high in price.

§ Costmary, or Ale-cost, smelling strongly of spearmint, but bitter. It was formerly used in brewing, and was introduced from Italy more than three centuries ago. It grows about old cottage enclosures, and the Manx call it sweet-leaf. Unless seen in flower it somewhat resembles *Pyrethrum Balsamita*, called camphor-plant, which is quite naturalised.

and Forbes adds the dead-nettle, the avens, the toad-flax, the cross-leaved bedstraw, and a few other plants; but, considering the small extent of the ground, this is not remarkable. One of the bedstraws *(Galium verum)* is so profuse that the air in July is filled with its perfume.* To the relations of the Manx Flora and Fauna we shall again advert hereafter. There is, perhaps, greater affinity of the Flora to that of the nearest Scotch or English lands than to that of North Wales; thus, one of the few sub-alpine plants assigned to the island, *Saxifraga aizoides*, is rather an English than a Welsh plant.

Contrary to what we have observed as regards the island flora generally, few spots are more productive in marine productions of the animal kingdom, and the Manx mollusca were especially studied by Forbes, and that as found at different depths, or in what he termed bathymetrical zones—littoral, laminarian, coralline, infra-medial, and abyssic. The last he had little opportunity of examining, and erroneously concluded that life soon ceased in it. Forbes considered that the Irish Sea is a kind of neutral ground, zoologically speaking, and his own island is somewhat curiously situated in the centre of it; but there are fewer of his Lusitanian species of mollusca than of plants, many Atlantic or western species, and a few of a south-British character; the generality may be said to be rather Celtic especially than European, with a small per-centage of boreal species. Forbes also paid great attention to the animals themselves in contradistinction to their shells, and in his later works to their geological distribution. In 1838 he published his "Malacologia Monensis," and in 1853 the "British Mollusca," in conjunction with Mr. Hanley. In the Malacologia he teaches that "a species is defined, unalterable, original, approaching but never uniting. Varieties are forms depending on local or accidental causes, diverging from the normal type, but often, and with facility, returning to it." Would he have spoken so decidedly in these days?

In Douglas market may often be seen at least a score of different kinds of fish, so bountiful are our seas to the island, set as it were in their centre. Forbes dredged off Ballaugh, where, however, at the present time, there are fewer facilities for doing so than at Ramsey. The Ballaugh scallop-bed is about four miles out, in twenty or thirty fathoms, and with deeper water on each side; similar reefs occur off Maughold Head and Laxey, and these may be easily dredged by the aid of the Ramsey boatmen. The bottom off Douglas is different, being coralline, with beds of Pectunculi. Port Erin is a good locality for the Naturalist, the fishing lines and lobster pots bringing up many interesting specimens.

Of land and fresh-water shells, *Helix aspersa* abounds in the island, *H. lapidicida* seems scarce. *Limax gagates* was found near Peel by Forbes, but he did not detect the minute Achatina. Many of the larger Limnæi, as well as Anodon, Paludina, and Cyclostoma are absent, as they are mostly from Ireland and the North of Britain, but rather at home in the south, seeming as if they had invaded England

* Forbes perceived the specific value of the variations in British Polygalæ, and the very different forms which Euphrasia takes in some situations.

before it had ceased to be continental, but after Ireland and the Isle of Man had become separated from it. *Unio Roissyi* Forbes found in the river at Kirk Braddon, and we there picked up some fragments of the valves.

The young Naturalist records finding the bone (so called) of the cuttle-fish on the Manx coast, but the animal is in reality somewhat a southern species; we got a large mass of the ova of another cephalopod (*Ommastrephes todarus*) off the Calf, resembling in everything but size those of Sepiola. To the naked-gilled molluscs which he records in the Malacologia must be added the beautiful *Dendronotus arborescens* from near the same place, and the fine *Doris tuberculata* or *Argo* found on Conaster and elsewhere, as in a cavern at the foot of Peel Castle rock; also *Eolis viridis* and *Aplysia* at Douglas. Of the shelled gasteropods we got *Capulus Hungaricus*, *Emarginula fissura*,* and *Fissurella Græca* from the Ramsey scallop-bed, as Forbes had already done; *Trochus Montagui* and *tumidus*, Douglas; *Acmæa testudinalis*, Ramsey; *A. virginea*, much more common than the last on scallop shells; *Trophon clathratus*; lastly, *Chiton Asellus* and *cancellatus*, F. and H., must be added to the list.† Of the common limpets, under the name of flitters, the poorer Manx make their soup.

As regards bivalve molluscs we might expect to meet with Brachiopoda in the deeper water around the island, and our friend found a single specimen of Crania at Ballaugh. Ramsey is rich in bivalves. I found a specimen of *Isocardium cor* there, many years back, with the valves still united by the ligament; also *Pecten tigrinus*, living, in the scallop-bed; *Tellina incarnata*, Douglas; *Venus verrucosa*, fine living species of this southern species, both at Douglas and Ramsey; *Tapes aurea* and *decussata*; *Solecurtus candidus*; *Psammobia Tellinella*, Douglas, by the dredge; these, with the exception of the last species, are not in Malacologia Monensis. We append in a note a list of other species, all of which we have found, but which are generally in that work,‡ also of Crustacea, mostly brought up by the dredge or in the lobster pots.§

We dredged *Comatula rosacea* off Douglas, but get it much finer between Port Erin and the Calf, from the source already alluded to.

* My specimens appear to be *E. Mülleri*.

† Also fine specimens of *Trochus Magus* and *zizyphinus*, with a white variety of the latter found on Conaster Rock, *Bullæa aperta*, *Natica Alderi*.

‡ Bivalve Mollusca—*Lima fragilis*, Ramsey scallop-bed; *Cardium Norvegicum*; *Lucina flexuosa*, *L. borealis*; *Lucinopsis undata*, Ramsey; *Cyprina Islandica*, sometimes with a large growth of serpulæ attached, Ramsey; *Mactra stultorum*, Ramsey, *M. elliptica*, Douglas, *M. truncata* and *subtruncata*; *Astarte Danmoniensis*; *Artemis exoleta*, Ballaugh, *A. lincta*; *Venus ovata*, *V. casina*, *V. fasciata*, Ramsey, *V. gallina*; *Psammobia Ferroensis*, Ramsey by the dredge, *P. vespertina* less plentiful than the last. Add also *Tellina crassa* et aliæ, *Donax anatina* (*minor*, *nitida*), *Nucula margaritacea* and *tenuis*, *Pectunculus Glycimeris*. *Solen marginatus*, *Syndosmya intermedia* et aliæ, *Anomia striata* found on the inner surface of Pectens, very delicate, the lower or perforated valve convex, though often scarcely present.

§ Crustacea—*Stenorhynchus Phalangium*, Bell, Port Erin; *Inachus Dorsettensis* ibid, *I. Dorynchus*, ibid; *Pisa Gibbsii*; *Eurynome aspera*, Douglas; *Pilumnus hirtellus*, Port Erin; *Portunus corrugatus*, ibid; *Ebalia Pennantii*. Ramsey scallop-bank; *Porcellana longicornis*, ibid; *Galathea squamifera*, Douglas bay, under stones, *G. strigosa*, much larger than the last, Port Erin. *Astacus Norvegicus* is seen in quantities in Douglas market.

Asterias glacialis, from the same place, was a splendid object when just taken up from the sea, of which Forbes's figure in the British Star Fishes (1841) gives but a poor idea; it reminds one rather of the frame work of a crown, with the jewels all gone. *Luidia fragilissima*, (lingthorn,) *Goniaster Templetoni*, and *Asterina gibbosa*. Off Ramsey occurred *Ophiura granulata* and *albida*, besides *O. rosula*, *bellis*, *brachiata*, and *neglecta*, recorded by the Professor, as were *Uraster hispida*, *Solaster endeca*, and the beautiful Palmipes, long since taken by us, but in a different locality, namely, the Diamond Fishing-ground, in the British Channel, possibly named from the occurrence of the animal, which is so called by the Sussex fishermen.

The Isle of Man appears, then, upon the whole, to have more affinity to Ireland than to its other surroundings. It has no mole, toad, or snake, as is the case with the latter country, and both had the great elk, which was occasionally engulfed in their deep curraghs. The frog was a new importation in both countries in Camden's time, though it is now common. There are newts in the island, the crested and smooth, and as many lizards, *Lacerta agilis* and *Zootoca vivipara*, Bell. The hedgehog was originally introduced, but is now common. The pole-cat is absent, but the stoat is common, the only species of the Mustelidæ, as it is in Ireland. The water-rat is found, the squirrel is absent. The tailless cat is, probably, aboriginal, both here and in Cornwall. Many of the Manx fowls are destitute of tail feathers. There may be some physical reasons for these peculiarities, but what they are must be left for others to explain. The habits and language of the natives are also allied to those of the Irish, with, no doubt, a trace of the Scandinavian.

One bird derives its specific name from Mona, the Manx shearwater, but it no longer frequents its ancient resort, the Calf. That peculiarly British bird, the grouse, has become extinct. The magpie is recorded to have been brought to the island by man; and Camden says there are no woodpeckers, jays, or mawps (?). The mischievous Irish or grey crow, and the red crow or chough, are more common in some parts than the black crow. The raven and peregrine falcon are not absent from the highest rocks. There are, also, the long-eared owl, the heron, and a host of interesting sea-birds.

FRESHWATER LIFE.—2. ROTIFERA.

BY EDWIN SMITH, ESQ., M.A.

In pursuing our studies of the minute forms of Freshwater Life, we cannot fail to encounter a number of creatures much smaller than the Entomostraca before described, yet quite distinguishable with the aid of a simple lens, sailing through the water with an easy, swinging motion; or grazing, like small cattle, among the threads of algæ; or moored by the tail to some green spray, while a curious ciliated head is stretched

forth in the act of feeding. The cilia will be seen to move in such rapid and well-timed succession as to look like revolving wheels; and so perfect is the optical illusion that you feel how appropriately these creatures have been named "Wheel-bearers," or Rotifera.

Their exact place in the animal series has not yet been finally determined. Provisionally they may be referred, as an order, to the somewhat miscellaneous class *Scolecida*, in the sub-kingdom *Annuloida*. On the whole, they appear to have strong affinities to the worm-like animals of the class just mentioned, as well as certain points of resemblance to the lower crustaceans, and to the larval forms of Echinodermata.

The Rotifera attain a maximum size of about 1-36th of an inch. Some are as small as 1-400th of an inch, or smaller. They are of a higher type of organization than the Infusoria, with which they were formerly grouped, since they have an obscure segmentation of the body, a completely separate alimentary canal, and a water-vascular system; and they never multiply by budding or self-division. They have a right and left, a dorsal and ventral, and a head and tail aspect; the end answering to the head moving habitually forwards, with the back upwards. Some are fixed by a foot-stalk to water-plants during the whole or the greater portion of their existence; but the majority are free-swimming. The former use the ciliated wreath to urge food to their mouth; the latter use it as a locomotive organ when in motion, and a feeding organ when at rest. Few things are more strikingly beautiful than this ciliated wreath in full activity. At intervals it is drawn in and tucked out of sight, so as completely to alter the look of the animal. But after a time it issues forth again, expands, and resumes its work. The food, received by a distinct mouth, is caught by a sort of champing gizzard, which has been likened to a pair of toothed hammers and a double anvil, and is there crushed small before admission to the stomach. In this receptacle, which is of variable size, the food is digested. The refuse of digestion then passes along an intestine; and finally, in most kinds, though not in all, is got rid of by a distinct orifice, connected with a cloaca, into which the ovary and a contractile vesicle also open. There is no heart; but a water-vascular system is present, consisting of two convoluted tubes, one on each side, furnished at intervals with short pipes lined with cilia, which lead into the general cavity of the body. The lower ends of these tubes open into the aforesaid contractile vesicle; and thus, the pulsations of the vesicle and the vibrations of the cilia keeping up a current, the fluids of the body are refreshed by being brought into communication with the outer water.

Of the nervous system, the following are the main features:—Near the back of the neck there is found a ganglionic mass, on which are mostly seated one or more eye-spots, generally of a bright crimson colour. Projecting from about the same place may often be seen a little telescopic feeler, armed at the tip with minute bristles; or the bristles may be sessile in a small hollow. Muscles pass lengthwise from end to end of the body, and ring-wise at intervals round it, by which the external

shape can be more or less altered, enabling some species to crawl about like a leech. Other muscles assist the movements of the ciliated wreath, as well as those of the tail-foot. Under careful illumination I have occasionally observed muscular striæ.

The body-cavity, with its various internal organs, is protected by an integument of greater or less firmness, shaped like a shield, a boat, a spindle, a vase, and so forth. In those cases where the integument is hardest, it may be termed the *lorica*, corresponding to the carapace of Entomostraca, and having a similar chitinous composition. Its surface is bare of cilia, but it is not unfrequently armed with lateral or terminal spines. The only approach to an articulate appendage possessed by Rotifera is that which I have called the tail-foot. It is not a prolongation of the back, and is, therefore, not a true tail. Coming off from the under surface of the body, below the anal orifice, it may be regarded as a kind of foot. It is capable of being shortened, either on the telescopic principle, or, when soft, by contracting in wrinkles. The basal portion varies considerably in length, being reduced sometimes to a mere stump. At its narrower end are often inserted, movably, one, two, or three styles, or dagger-like bristles, which may be very long. When these are two in number, they strongly remind us of a pair of scissors; when they are three, the middle one is small. With this organ the Rotifera steer themselves in the act of swimming, or hold on to some support while groping about for food, or even, in a few instances, take veritable leaps.

With regard to reproduction, the same phenomena of parthenogenesis have been observed, which we noticed when describing the Entomostraca. The young are born from two very distinct kinds of eggs; the summer eggs, which are generally, if not always, virgin produce; and the winter eggs, which have been duly fecundated. The latter are preserved against the cold by a peculiar shell, till spring returns to hatch them. While the females multiply in enormous numbers, the males are very rarely met with. The latter, moreover, are, as a rule, so unlike the former in appearance, that it is difficult to recognise them as belonging to the same species. It is a curious fact, that in all males the alimentary canal is either absent or rudimentary. They are, consequently, short-lived.

Before briefly considering particular examples of Rotifera, I will here give my authorities for the preceding anatomical sketch, while naming a few works to which the student can refer for a fuller account of the subject. He will find that the ablest observers are by no means unanimous on many important points in the anatomy and life-history of these somewhat puzzling animals.

Works of reference :—Pritchard's "Infusoria;" Rolleston's "Forms of Animal Life;" Huxley's "Anatomy of the Invertebrated Animals;" Gosse's "Papers in the Philosophical Transactions."

[TO BE CONTINUED.]

PARASITES OF MAN.*

BY T. SPENCER COBBOLD, M.D., F.R.S.

[*Continued from page 59.*]

In continuing this record it is, perhaps, as well that I should remind the members of the Section that the Cestodes differ essentially from the Trematodes in that the so-called species are multiple in character. What is spoken of as a tapeworm is not *one* creature, but in reality a multitude of organisms, or zooids, arranged in single file. The head itself is merely the topmost zooid, modified in shape, and armed with sucking disks, so as to form a means of anchorage for the whole colony. This cephalic holdfast, as it might be called, is in some sense the counterpart of what we see not only in the fixed polypes, but also in the free compound medusæ. In carrying out the analogy it must not be forgotten that the solid hydrorhiza of an ordinary Sertularian polype was once a free swimming ciliated larva, whilst the inflated end of the cœnosarc forming the float of Physalus had a similar origin. In all these cases the metamorphosis of a larva, either directly or indirectly, secures the formation of an organ of anchorage or support involving the welfare of the entire chain or colony of zooids. It is sufficient to insist upon the strict analogy of these phenomena without suggesting questions of homology. An ordinary human tapeworm (such, for example, as that derived from eating measled beef) consists of about twelve hundred zooids, or proglottides. Each proglottis is bisexual, and, when mature, is capable of holding, according to Leuckart, about 35,000 eggs. The entire colony of twelve hundred zooids is renewed every three months, and thus it follows that the amount of egg-dispersion annually resulting from a single beef-tapeworm cannot be less than twelve millions. In all probability this calculation is very much below the mark, seeing that the 35,000 impregnated germs capable of existing in the fully mature proglottis, at a given period, do not by any means serve to fix the limit of the possibilities of egg-formation within the proglottis. Of course, as compared with the quantity of germs distributed, the number that survive and come to perfection, as Tæniæ, must be infinitesimally small.

CESTODA.

13.—*Tænia mediocanellata*, Küchenmeister.

Synonymy.—*T. saginata*, Goeze; *T. dentata*, Nicolai; *T. inermis*, Moquin-Tandon; *Tæniorhynchus*, Weinland.

Larva.—A simple Scolex, known as the beef measle, (*Cysticercus bovis*, Cobbold.)

Intermediate Host.—The Ox, (*Bos taurus*,) and all its varieties. The cattle of the Punjab are largely infested. As many as 300 Cysticerci have been counted by Dr. Joseph Fleming in a pound of flesh taken from the psoas muscles.

* Read before the Microscopical Section of the Birmingham Natural History and Microscopical Society, March 19th, 1878. Mr. Hughes, on Dr. Cobbold's behalf, exhibited the following specimens:—The beef-tapeworm, (*Tænia mediocanellata*,) and its measle, (*Cysticercus bovis*,) the pork-tapeworm, (*T. solium*,) and its measle (*Cyst. cellulosæ*,) from the human brain; the slender tapeworm, (*T. tenella*,) the ridged tapeworm, (*T. lophosoma*,) the dwarf tapeworm from Egypt, (*T. nana*,) and the elliptic tapeworm, (*T. elliptica*.)

Remarks.—This cestode, often called the beef tapeworm, is much more prevalent than the pork tapeworm. Taking all classes of infested persons together it probably occurs in about ninety per cent. Of the cases of tapeworm coming under my own observation not less than ninety-six per cent. have been of this species.

Experiments on Animals.—The larvæ have been reared in cattle by Leuckart, Mosler, Cobbold and Simonds, Probstmayer, Zurn, St. Cyr, Perroncito, and M.M. Masse and Pourquier. The measles are usually found in the voluntary muscles in the beast and in the connective tissues. I have, however, twice found them in the liver and once in the lungs.

Experiments on Man.—Dr. Oliver reared the adult tapeworm in a Mahommedan Syce and in a Hindoo boy. Professor Perroncito recently persuaded Dr. Ragni, Mr. Gemelli, and others of his pupils to swallow beef-measles which had been subjected to varying degrees of temperature (45°—47° C.) One of the students thus reared a mature Tænia within himself in fifty-four days.

Literature.—Standard works; especially that of Leuckart. See also Cobbold; Tapeworms, (3rd edit.,) 1874. Perroncito; Experamenti, &c., Lo Studente Vet., (Parma, 1876, p. 146,) and various papers in The Veterinarian, (July and December, 1877.) Masse et Pouquier in Montpellier Med. Journal Mensuel de Médicine, 1876. See also Heller, (quoted below.)

14.—*Tænia solium*, Linnæus.

Syn.—*T. cucurbitina*, Pallas; *T. humana armata*, Brera; *T. lata*, Pruner; *T. vulgaris*, Werner.

Larva.—Simple scolex; familiarly known as the pork-measle, (*Cysticercus cellulosæ* of authors.)

Int. Host.—The Hog, (*Sus scrofa*,) both in the wild and domesticated state. As this measle also develops within the human body, man may himself become an intermediate bearer, and, by an act of cannibalism on the part of another man, prove a source of tapeworm-infection.

Remarks.—This cestode, though usually regarded as the common tapeworm, is comparatively rare in England. It is chiefly found amongst the poor, who are large consumers of pork which is often imperfectly cooked. In Iceland the pork tapeworm is rather more common than the beef tapeworm.

Experiments.—Pork-measles have been reared in the pig by Van Beneden, Haubner, Küchenmeister, Leuckart, Gerlach, and others. Küchenmeister likewise reared both mature and immature Tæniæ of this species in condemned criminals. Under Leuckart's auspices, several young persons voluntarily allowed themselves to become infested by swallowing fresh and living pork-measles.

Lit.—The works of Leuckart and Küchenmeister; and also, more particularly, Heller's Darmschmarotzer, in Von Ziemssen's Handbuch, (Bd. VII., s. 601,) and in the Anglo-American Edit. Davaine, Les Cestoïdes, in Dictionnaire Encyclop. des Sciences Med. (New Edit.)

15.—*Tænia tenella*, Cobbold.

Syn.—None; but Pruner gave the title (*T. tenella*) to a worm, which was probably *T. solium*.

Larva.—At present unknown, but conjectured to be the mutton-measle, (*Cysticercus ovis*, Cobbold.)

Int. Host.—Probably the Sheep, (*Ovis aries*,) which is occasionally infested by armed Cysticerci.

Remarks.—On five separate occasions I have observed measles in joints of mutton brought to my own table. I have also several times encountered a very slender tapeworm in man, which is not improbably the adult representative of this Cysticercus. Examples of the mutton-measle have also been seen by Prof. Heisch, Dr. Kirk, and Dr. Maddox.

Experiments.—The only breeding experiment performed by me with this slender tapeworm was on a lamb (1872). The result was negative.

Lit.—Cobbold; Tapeworms (3rd Edit.); and in Supp. to Entozoa, 1869 (p. 27). Maddox, On an Entozoon, with ova, found encysted in the muscles of a sheep; Nature, May 15th, 1873; Month. Micr. Journ., June, 1873; Lond. Med. Record, Aug. 6th, 1873.

16.—*Tænia lophosoma*, Cobbold.

Syn.—None. A malformed tapeworm, (Heller.)

Larva.—Unknown.

Remarks.—This a good species, notwithstanding the criticism that has been bestowed upon my determinations. It is quite distinct from Küchenmeister's variety from the Cape of Good Hope. The reproductive papillæ are placed all on one side of the strobile throughout.

Lit.—Cobbold; Tapeworms. Davaine Les Cestoïdes, (l.c. p. 573.;) Heller, (l.c. s. 594.)

17.—*Tænia nana*, Siebold.

Syn.—*T. ægyptiaca*, Bilharz; *Diplacanthus*, Weinland.

Larva.—Unknown.

Int. Host.—Probably an insect, (Leuckart.)

Remarks.—This little tapeworm has only once been found. It was discovered by Bilharz in an Egyptian boy in very large numbers. The finest examples did not quite reach an inch in length.

18.—*Tænia madagascariensis*, Davaine.

Syn.—None.

Larva.—Unknown.

Remarks.—Discovered by Dr. Grenet (at Mayotte, Comores) to have passed from two young children. The reproductive pores are uniserially disposed, as in *T. lophosoma*.

Lit.—Davaine; Art. Les Cestoïdes (l.c. p. 577 et seq.)

19.—*Tænia elliptica*, Batsch.

Syn.—*T. canina*, Pallas; *T. cateniformis*, Rudolphi; *T. cucumerina*, Bloch; *Dipylidium*, Leuckart.

Larva.—A louse measle, (Cysticercus *Tæniæ ellipticæ*.)

Int. Host.—The lice of the dog and cat, (*Trichodectes latus* and *Trich. subrostratus*.)

Remarks.—Most helminthologists believe that this cestode is identical with the cucumerine tapeworm of the dog. At best it is a mere variety.

Lit.—Melnikow; in Archiv fur Naturgeschichte, 1869; and in Recueil de Méd. Vet., 1871.

20.—*Tænia flavopuncta*, Weinland.

Syn.—*T. flavomaculata*, Molin; *Hymenolepis*, Weinland.

Larva.—Unknown.

Remarks.—This is a small worm which has only been once seen. It was obtained by Dr. Palmer, in America, from an infant. As in *T. lophosoma* and *T. madagascariensis*, the reproductive papillæ are uniserially arranged.

Lit.—Weinland; Tapeworms of Man, 1858, and in his Beschreibung zweier neuer Tænioiden aus dem Menschen, 1861.

[TO BE CONTINUED.]

ENTOMOLOGICAL BOOKS FOR BEGINNERS.

BY W. G. BLATCH.

Amongst the great number of popular books on Entomology very few are of real service to the student of that interesting science, and it too often happens that beginners expend a considerable amount of money uselessly and involve themselves in almost hopeless confusion, for want of a little friendly counsel to aid them in making, at the outset, a selection of the most suitable books. A few suggestions on this subject may therefore be not unacceptable to at least the younger Entomological readers of the "MIDLAND NATURALIST." As, however, it will be impossible to give in this number a list of all the best books on insects, I will limit this notice to two works on general Entomology, and to a few of such as illustrate some of the more prominent "Orders."

Undoubtedly there is no better book on general Entomology than "Westwood's Introduction to the Modern Classification of Insects," 2 Vols., 1839. It is, however, hard to obtain, (being out of print,) and commands a high price, (£3 10s. is now charged for a fair copy,) but the book is necessary to all who desire not to be Entomologists in name only.

Not improbably the opportunity, and perhaps the money, to purchase "Westwood" may not be at once available. It will therefore be necessary to recommend some sort of a substitute. Here is one ready to hand—cheap, but good; easy to understand, but thoroughly trustworthy, and withal containing excellent coloured figures of insects of all "Orders,"—"Staveley's British Insects," Lovell Reeve, price 10s. 6d.

Then as to special books, beginning with the Coleoptera, the works of Mr. H. E. Cox and Mr. E. C. Rye are the only two that need be mentioned. "Cox's Handbook of the Coleoptera or Beetles of Great Britain and Ireland," (1874,) 2 vols., 17s. 6d., is indispensable. It is far from perfect, but is a great improvement upon previous guides to the study of British beetles. The book is published by Mr. E. W. Janson, (himself a most accomplished Coleopterist,) at 28, Museum Street, London.

"Rye's British Beetles" may be used advantageously as a sort of stepping-stone to "Cox." In a familiar, yet scientific style, the author opens up a veritable royal road to Beetle-knowledge. He has, in fact, succeeded in making his book both charming and useful. In addition to the chapters treating on the several families and genera of Beetles, it contains a glossary of technical terms, a systematic catalogue of British Coleoptera, and a number of nicely coloured plates. It is published by Lovell Reeve, price 10s. 6d.

A copy of Dr. Sharpe's "Catalogue of British Coleoptera," (published by Mr. E. W. Janson,) price 1s., should also be obtained.

The Lepidopterist has a far better choice of books than the Coleopterist, there being a large number of excellent "Manuals" and "Histories" of British Butterflies and Moths in the market. I consider, however, that there is not a more accurate and useful work, in

this branch of Entomology, than "Newman's Natural History of British Butterflies and Moths." The life-history of each species is described with careful minuteness, and every insect named is represented by an exquisitely drawn portrait. With the help of the description and figure there given, it is perfectly easy for the veriest tyro to recognise any particular butterfly or moth in his collection. The "Butterflies" and "Moths" are published separately, but can also be had bound together in one volume. The publisher is T. P. Newman, 32, Botolph Lane, Eastcheap, E.C., and the price is about 21s. for the two volumes.

I will conclude the present notes by recommending (in reply to a request that has been addressed to me) "a cheap, easy, reliable book on 'Bees.'" There exist several very valuable works on this subject, some of which may be specially referred to at a future time; but I do not know of one which answers the above description more fully than "Shuckard's British Bees," (Lovell Reeve, price 10s. 6d.) It is a small volume, but contains a large amount of trustworthy information about this most interesting section of the order Hymenoptera. A number of woodcuts of dissections, and sixteen beautifully-coloured steel plates, (containing about 100 figures,) greatly enhance the value of the book.

POND LIFE.

With my friend S. S. R., I have again visited the "Productive Pond," (ante p. 76,) and two others, in one of which my friend had some time back found *Melicerta tyro*, the new species found by Dr. Hudson at Sutton Coldfield. At first we thought we had found a specimen, but it proved to be *Floscularia campanulata*, with a large cluster of eggs at the bottom of the case surrounding its foot. I am sorry to report that *Conochilus volvox* is becoming scarce. There are, however, other rotifers in great abundance. I found the following this day, (March 16th,) besides other forms of animal and vegetable life too numerous to mention:—*Chætonotus larus*, *Conochilus volvox*, *Cephalosiphon limnias*, *Melicerta ringens*, *Floscularia campanulata*, *Notommata aurita*, *Synchæta pectinata*, *Polyarthra platyptera*, *Rattulus lunaris*, *Mastigocerca rattus*, *Euchlanis dilatata*, *Salpina mucronata*, *Metopidia acuminata*, *Rotifer vulgaris*, and two other species which I could not identify. One of the ponds we found literally full of *Volvox globator*. Recently I spent a day at Sutton Park, and found *Limnias ceratophylli* in extraordinary abundance, and a few specimens of *Stephanoceros Eichhornii* and *Melicerta ringens*. In another locality I found a great abundance of *Anuræa acuminata*, a sprinkling of *Pterodina patina*, and some few specimens of *Anuræa foliacea* and *Dinocharis pocillum*.—On the 21st February I found here, for the first time this season, the fine Polyzoan *Fredericella sultana*. This is, I think, very early for its appearance in a natural habitat. In a zoophyte trough I have now some fine young *Plumatella repens* just commencing life, and protruding their lophophores whilst still enclosed between the valve-like plates of the statoblasts, from which they have grown. They are objects of great beauty and, being very transparent, their anatomy is plainly visible under the microscope.—THOS. BOLTON, Hyde House, Stourbridge.

RAINFALL AT WOLVERHAMPTON.

The average Rainfall at Wolverhampton for the last nineteen years is 28·034 inches per annum, the maximum occurring in 1872 which was a very exceptional year showing a total of 45·47 inches; the maximum quantity falling in the month of July, and amounting to 5·93 inches, and the minimum in March when 1·85 inches only fell. On three occasions in this year there were extraordinary falls in short periods, namely, on the 24th of June 1¼in. fell in forty minutes, equal to 150 tons per acre, and on the 6th and 7th July 3-10ths of an inch, and ⅜in. respectively fell in fifteen minutes. Leaving this very exceptional year out of the question, the average Rainfall for the last eighteen years would be 27·065 inches. In the year 1875 there were very heavy falls, making a total of 38·13 inches for the whole year. Of this 8·12 inches fell in July, and 12·41 inches in the months of September and October. The following table shows the total quantity of Rain falling in each separate month of the year; also, the average for each month for the last nineteen years:—

Year.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.	Totals.
1859	·95	1·26	1·68	2·96	·88	2·91	3·56	3·48	2·36	3·01	2·66	1·87	26·62
1860	2·60	·58	1·92	·95	3·06	4·71	1·60	5·94	2·05	1·67	1·86	3·55	30·49
1861	·93	2·07	3·37	·87	·87	4·04	4·44	1·08	2·40	1·51	1·37	1·28	24·68
1862	1·93	·49	3·34	2·48	3·79	1·55	1·78	1·94	3·54	2·15	1·00	1·72	25·71
1863	1·99	·81	·85	1·01	·88	4·78	1·19	2·66	3·25	3·22	2·44	1·06	25·58
1864	1·17	2·01	2·47	1·29	2·34	2·50	·71	·94	1·71	2·24	2·61	2·61	22·60
1865	1·76	1·25	1·14	·66	3·15	1·58	1·62	3·96	·11	3·61	2·31	·97	22·14
1866	1·84	1·87	1·82	·72	1·79	3·23	1·74	3·95	5·58	2·48	2·13	1·76	28·86
1867	3·39	1·69	2·80	2·11	1·58	1·45	3·71	2·18	2·70	3·31	1·09	1·97	27·98
1868	1·91	2·28	1·85	1·94	1·65	·80	·89	4·55	2·07	2·01	1·46	5·46	26·07
1869	2·45	1·62	1·88	1·54	5·11	1·18	·48	1·87	6·22	1·58	1·80	3·35	28·74
1870	2·07	1·97	1·86	1·02	1·02	·79	1·89	2·21	·58	4·17	1·92	2·85	21·85
1871	1·67	1·68	·76	2·72	1·65	3·80	3·88	1·01	5·96	2·65	·66	1·68	28·22
1872	4·50	2·70	1·85	3·54	2·27	5·76	5·93	4·09	2·10	5·61	3·68	3·49	45·47
1873	2·59	·95	2·57	·85	2·62	3·19	3·06	2·46	2·11	2·82	2·04	·54	25·27
1874	2·86	2·75	·80	1·44	1·98	·51	2·06	3·84	3·02	1·92	3·48	2·89	26·55
1875	2·76	1·21	·78	·77	1·57	3·48	8·12	2·80	6·21	6·20	3·31	1·47	38·13
1876	1·62	2·57	2·28	3·27	·66	3·17	2·15	1·50	4·02	1·55	3·55	4·12	30·41
1877	3·60	2·25	2·08	1·95	2·82	1·86	4·07	4·82	1·99	1·72	1·91	1·72	29·79
Totals	42·14	31·46	35·97	31·18	39·50	50·69	51·78	53·20	57·98	52·88	41·78	44·10	532·65
Average per month for nineteen years	2·22	1·65	1·89	1·64	2·08	2·66	2·72	2·80	3·05	2·78	2·19	2·32	28·034

GEO. J. C. BROOM, A.I.C.E.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF FEBRUARY, 1878.

BY W. J. HARRISON, F.G.S.

February, 1878, was, without doubt, an unusually fine, mild, and dry month. The general uniformity of the weather over the Midlands has also been remarkable. Thus, nearly every observer notes with pleasure the fine weather on the 17th, which produced the maximum temperature at almost every station, the extreme being 62° at Burley-on-the-Hill, and 61° at Cheltenham. Similarly the greatest cold was experienced everywhere on the 1st, 7th, and 8th, being a continuation of the cold period which marked the end of January. The minimum thermometer fell to 19° at Stoney Middleton on the 6th, 7th, and 8th, and to 19·5° at Coston on the 8th. Rainfall was about two-thirds of the average for February, and at most stations the maximum fall occurred on the 12th, which was a changeable and stormy day. Greatest fall was 2·70in. at Alstonfield, with ·69in. on the 12th.

STATION.	OBSERVER.	RAINFALL. Total for M. In.	Greatest fall in 24 hours. In.	Date.	No. of rainy d.	TEMPERATURE. Greatest ht. Deg	Date	Great'st cold Deg	Date.
GLOUCESTERSHIRE.									
Cainscross, Stroud	W. B. Baker, Esq.	1·81	·56	12	9	56.0	28	22·0	1
Cheltenham	R. Tyrer, Esq.	1·56	·44	12	12	61·0	27	21·8	1
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	1·28	·37	12	12	55·0	17	24·0	1 & 8
Whitchurch	A. B. George, Esq.	1·44	·38	12	12	60·0	7	27·0	8
Woolstaston	Rev. E. D. Carr	1·54	·37	12	14	56·5	17	26·0	1
Leaton Vicarage, Shrewsbury	Rev. E. V. Pigott	1·01	·24	28	15	58·7	17	21·6	1
More Rectory, Bishop's Castle	Rev. A. S. Male	1·48	·40	12	14	56·0	17	21·0	1
Larden Hall, Much Wenlock	Miss F. R. Boughton	1·68	·44	12					
Bishop's Castle	E. Griffiths, Esq.	1·30	·34	12	13	60·0	17	23·0	1
Cardington	Rev. Wm. Elliot	1·88	·34	28	12				
Adderley Rectory	Rev. A. Corbet	1·44	·43	12	14				
Stokesay	Rev. J. D. La Touche	1·26	·38	12	12				
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	1·91	·64	12	13				
Stoke Bliss	Rev. G. E. Alexander	1·52	·44	12	13	57·0	17	29·0	7
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq	1·58	·46	12	14	61·7	17	22·3	1
Blockley	R. B. Belcher, Esq.	1·97	·44	12	12				
West Malvern	A. H. Hartland, Esq.	1·98	·40	12 & 28	12	57·5	17	23·0	6
Pedmore	E. B. Marten, Esq.	1·48	·51	12	14	58·0	17	26·0	7
Stourbridge	Mr. J. Jeffries	1·29	·40	12	13	56·0	17 21 28	24·0	7
St. John's, Worcester	G. B. Wetherall, Esq.	1·54	·25	27	12	56·0	17	24·0	8
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	0·97	·35	13	14				
Barlaston	W. Scott, Esq.	1·48	·26	28	12	56·8	17	23·2	7
Amblecote	Mr. J. Robins	1·18	·42	12	14	61·0	17	27·0	1 & 8
Dudley	Mr. J. Fisher	1·02	·38	12	10	58·0	17	28·0	1 & 8
Sedgley	Mr. C. Beale	1·04	·38	12	15	54·0	17	29·0	1 & 8
Kinver	Mr. T. Bolton	1·17	·35	12	16	57·0	17 19 [illegible]	21·0	8
Walsall	Mr. W. E. Best	1·07	·32	12	14	54·0	17	33·0	8 & 18
Grammar School, Burton	C. U. Tripp, Esq.	1·14	·36	12	14	55·0	28	23·0	1
Patshull Gardens	T. W. Dell, Esq.	0·78	·29	13	6	57·0	22	21·0	1
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	1·27	·34	12	12	57·0	17	22·0	1
Wrottesley	E. Simpson, Esq.	1·05	·25	12	12	52·7	28	24·0	1
Tamworth	W. Arnold, Esq.	0·92	·28	12	12				
Alstonfield Vicarage	Rev. W. H. Purchas	2·70	·69	11	11	55·5	17 & 18		
Tean Vicarage, near Cheadle	Rev. G. T. Ryves	1·81				57·5	17	24·0	1
The Heath House, Cheadle	J. C. Philips, Esq.	1·81	·43	12	12	58·0	17	27·0	1 & 9
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	1·74	·64	12	12	55·0	18	26·0	8
Coventry	J. Gulson, Esq.	1·57	·53	12	13	60·0	18	22·0	8
Bickenhill Vicarage	W. R. Capel, Esq.	1·18	·45	12	11	54·5	17	26·0	1
St. Mary's College, Oscott	Rev. S. J. Whitty	1·08	·37	12	11	60·1	17	26·5	1
Henley-in-Arden	T. H. G. Newton, Esq.	1·55	·51	13	12	60·0	17	21·0	8
Rugby School	Rev. T. N. Hutchinson	1·48	·31	27	12	58·4	17	25·0	8
DERBYSHIRE.									
Buxton	E. J. Sykes, Esq.	2·50	·53	28	15	53·0	17	23·6	9
Brampton S. Thomas	Rev. J. M. Mello	0·86	·42	12	9	54·0	28	22·0	9
Stoney Middleton	Rev. U. Smith	1·11	·27	28	11	58·0	16	19·0	6 7 & 8
Fernslope, Belper	J. G. Jackson, Esq.	1·97	·66	12	12	56·0	18	26·0	1
Matlock Bath	R. Chadwick, Esq., jun.	2·19	·50	12	14	54·0	17	22·0	1
Linacre Reservoir, Ches'field	C. E. Jones, Esq.	1·29	·45	12	11				
Willesly Gardens, Cromford	J. Tissington, Esq.	2·19	·68	14	9				
Stuffynwood Hall	R. Rolfe, Esq.	1·24	·43	12	8	58·0	17 & 21	27·0	6 & 8
Trent College	Rev. J. F. Fenn	1·36	·23	12	10	60·0	17	28·0	6 & 7
NOTTINGHAMSHIRE.									
Hodsock Priory, Worksop	H. Mellish, Esq.	1·01	·33	14	9	59·2	17	24·7	1
Grove House, Mansfield	W. Tyrer, Esq.	1·35	·45	12	11	58·6	17	24·6	1
LEICESTERSHIRE.									
Ashby Magna	Rev. E. Willes	1·51	·41	12	12	57·0	16	28·0	1
Market Harborough	S. W. Cox, Esq.	1·60	·34	12	11	56·0	17	28·0	7
Kibworth	T. Macaulay, Esq.	1·47	·42	13	14				
Foxton Locks	Union Canal Company	1·18	·33	13	8				
Town Museum, Leicester	W. J. Harrison, Esq.	1·24	·34	12	13	59·2	17	25·5	1
Belmont Villas, Leicester	H. Billson, Esq.	1·33	·41	12	13	59·0	17	25·8	1
Syston	J. Hames, jun., Esq.	1·10	·28	14	15	57·0	18	24·0	1
Waltham-le-Wold	E. Ball, Esq.	1·51	·37	25	11	56·0	17	26·0	1
Little Dalby Hall	G. Jones, Esq.	1·40	·43	12	11	57·0	17	24·0	1 & 9
Coston Rectory, Melton	Rev. A. M. Rendell	1·75	·39	25	14	59·5	26	19·5	8
Belvoir Castle	W. Ingram, Esq.	1·10	·30	13	13	59·0	18	23·0	1
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	1·46	·37	13	7				
Castle Ashby	R. G. Scriven, Esq.	1·57	·41	13	10				
Sedgebrooke	C. A. Markham, Esq.	1·59	·51	27	16	59·0	18	25·0	1
Kettering	J. Wallis, Esq.	1·73	·48	27	12	58·0	18 & 19	27·0	1
Althorp	W. F. Jakeman, Esq.	1·58	·45	27	12	56·0	17	23·0	8
Northampton	H. Terry, Esq.	1·58	·47	13	11	57·0	17	28·0	6 7 & 8
RUTLANDSHIRE.									
Burley-on-the-Hill	W. Temple, Esq.	1·81	·46	15	11	62·0	18	25·0	7
Tickencote	W. Hayes, Esq.	1·45	·28	12	11				
OXFORDSHIRE.									
Radcliffe Observatory	Mr. J. Lucas	1·35	·44	13	14	57·9	17	25·1	7
CUMBERLAND.									
Spital Cemetery, Carlisle	T. Bell, Esq.	1·79	·42	28	13	60·3	17	26·3	11
ISLE OF WIGHT.									
Ventnor Hospital	Hartley Sagar, Esq.	2·15	·60	13	15	56·8	17	30·5	8
CORNWALL.									
Altarnun Vicarage	Rev. G. Tripp	3·52	1·10	28	9	57·0	18	22·0	1

REMARKS ON THE WEATHER OF FEBRUARY.

Cheltenham.—The month opened with frost and dull, foggy weather, changing to genial weather on the 16th. This continued till the 24th, when dull days with wind and rain concluded the month. The 17th, 19th, and 21st were especially lovely days. Mean barometer (corrected) 30·264in. Mean temperature 42·2°. Whitchurch. A mild and open month. Temperature above the average. Woolstaston.—Mean temperature of month 41°. Mean daily average 11·2°. Leaton Vicarage.—An excessively mild month. Light westerly winds prevailed. Fog on 2nd and 10th to 14th, with east wind. Hoar frost on the 1st and 19th. Primroses in flower in numbers, and vegetation generally very forward. Bishop's Castle, (More Rectory.)—Snow on the 12th. Missel thrush, song thrush, chaffinch, and blackbird were all singing throughout the month, the last-named much earlier than usual at this place. The month began with a sharp frost and bright, cloudless days, but was afterwards throughout singularly mild and fine. The absence of tempests and high winds was remarkable for February. Bishop's Castle, (E. Griffiths, Esq.)—Rainfall again not more than half the average. Warm month, and vegetation very forward. The 12th was a very changeable day. St. John's, Worcester.—Barometer uniformly high. Average noonday temp. 2° below February, 1877. Rainfall a little less, but on exactly same number of days, with polar and equatorial currents in both months. This year greatest cold on 1st, last year on the 28th. Fruit trees in bloom—Pear, (Marie Louise and Bishop's Thumb,) damson, apricot, and gooseberry. Barlaston.—Rainfall ·89in. below average of last thirteen years. Mean temp. slightly above average. Light winds from all points, but chiefly S.E., S.W., and N.W. Barometer very high. Burton-upon-Trent.—Skating on shallow water on 1st. Picked woodbine in full leaf on 2nd, currant and gooseberry on 23rd, and rhubarb on 25th. Bees and wasps out on 17th. Lunar halo at 6 p.m. on 12th, accompanied by easterly gale with rain and snow at 9 p.m. Weston-under-Lyziard.—Snow and rain on the 12th. Wrottesley.—Snow and sleet on 12th. Mean temp. 39·4°; last year 41·6°. Tamworth.—Hard frosts on 1st, 7th, and 8th. Bar. very high. All spring warblers singing by the 4th. Rainfall greatly below average, and land working better than it has done since 1874. Hedges budding fast. Coventry.—Ground in excellent working order for spade and plough. Thrush, missel thrush, skylark, hedge-sparrow, wren, and chaffinch have been in full song during latter part of month, but the blackbird, although very abundant, has been unusually silent. Bickenhill Vicarage.—On the whole a dry but gloomy month, with but little sunshine and no winds. The early part cold, with frosts; the latter half mild. Henley-in-Arden.—Rainfall ·39in. below average of last seven years. Rugby.—February was remarkable for (1) the number of calm days—on sixteen days the wind was from 0 to 1; (2) the high average temperature; (3) the few days of sunshine—on only six days was any considerable amount of blue sky visible. Buxton.—Early part of month foggy and cloudy. In middle of month foggy mornings succeeded by bright sunshine. Snowdrop, crocus, and polyanthus blossomed. Few damp, cold, and windy days at end. Stuffynwood Hall.—Driest month since May, 1876, and very favourable for out-door work. Snow and sleet fell from 8 p.m. on 12th till 8 a.m. on 13th. Spondon.—Temp. above average. Much cloud. Worksop.—First fortnight cold and frosty, with thick fog on night of 8th. A very little snow on night of 12th. Mansfield.—Dry month, rainfall ·75in. below average of last seven years. Fog in middle of month. Bar. high. Coston Rectory.—Fine month, with high bar. Vegetation very forward, trees and hedges breaking into bud and leaf. Rain and snow on night of 12th. The 17th a perfect spring day. Last six days dull and wet. Belvoir Castle.—Remarkably dry month. The

old north-country proverb, "February fill dyke," completely falsified. Frosty nights from 6th to 13th. Vegetation active. One consequence of the mild winter is seen in the abundance of keep for stock. Turnips are in excess of the requirements of most farmers. Good hay £3 per ton. Many spring flowers have appeared with the winter aconite and snowdrop, which usually follow those harbingers of spring, violets, primroses, yellow crocus, double daisies, *Erica carnea*, *Anemone apennina*, *A. blanda*, *Myosotis dissitiflora*, *Rhododendron dauricum* amongst the number. BELMONT VILLAS.—Very mild month. Temp. below freezing point on five nights only. Mean 41·7°. S.W. winds on 22 days. CASTLE ASHBY.—Rainfall about average of last five years, (1·59in.) "February fill dyke" has a bad character, which, however, appears to be the reverse of the truth. Results of last five years at this station show it to be the driest month in the year except May, (1·51in. average.) BURLEY-ON-THE-HILL.—Snow and rain on 13th. ALTARNUN VICARAGE.—A remarkably dry month; the first ten days rather frosty. ORLETON.—First twelve days dry and cold, with severe frosts, but no snow; remainder of month warm but cloudy, little sunshine, rainfall nearly an inch below average. BRAMPTON, NEAR CHESTERFIELD.—8th, hazel catkins; 13th, snow on ground; 18th, ash leaf; 19th, lesser celandine and dog's mercury in flower; *Rosa arvensis* and sweet violet on 25th; *Rosa canina* on 28th.

Review.

Notes of Lessons on Elementary Botany. By W. BLAND, Master of the Endowed School, Driffield. (Bemrose's School Manuals.) London: Bemrose and Sons. Parts I. and II., 6d. each.

After reading the numerous text-books of Elementary Botany which the last few years have produced, and which repeat the old, old truths in a very similar and monotonous way, it is a relief to find one which strikes out a new line as this does. Were it for nothing else, it would be remarkable for the entire absence of the stock woodcuts, which have been repeated in one book after another till they have grown wearisome. Every one of the drawings, mostly by the author himself, with which this little book is adorned, is new. This point, however, concerns more the teacher than the taught; it is of greater consequence that they are exceedingly numerous, and bear the mark of having been copied direct from nature, with the exception of a few, which are all the more conspicuous amidst the general excellence. Some of them, as those illustrating the terms *monœcious* and *diœcious*, will be more instructive to young readers than a lengthy paragraph of description. A few of the illustrations are misleading, noticeably that of the cone (p. 23,) the salver-shaped corolla (p. 29,) the silique (p. 41,) and the lichen (p. 85.) That of the *Volvox* on p. 86 is strikingly inaccurate. The microscope with which Mr. Bland saw this must have resembled Sam. Weller's "patent gas microscope of *hextra* power." Imagine a distinctly oval body, adorned with eight large tubercles, each furnished with two stout cilia, whose length is equal to half the diameter of the *Volvox!*

The value of the book is marred by the inaccuracy of some of the derivations given. An *Antheridium* is so called not because it is "like a flower," but because in function it "resembles an anther," if it and similar words should not rather be considered diminutives; and an *Archegonium* is not the "chief female," but the "beginning of the female organ." We may also notice that the useful fibres of flax and hemp are derived from the inner layer of the *bark* (p. 12,) as the author himself

states on p. 90; that *valvate* means not "in folds," but "arranged like folding doors, *valvæ*;" that *ovary* does not mean "like an egg," (p. 36,) but "that which contains eggs." There are some sentences which a learner would misunderstand, but which the teacher, who knows what the author intended to say, can easily correct; *e.g.* he appears to state that the stellate form of cell is produced by the mutual pressure of adjacent cells (p. 87.) These, however, are small faults, easily corrected in a new edition, and they are pointed out with that view. For the purpose for which the book was written it is well adapted—Part I. to give a class of young children their first notions of morphology and classification; Part II. containing a practical experimental introduction to vegetable anatomy and physiology for senior scholars, based upon the South Kensington course. This part, indeed, comprises much information upon the lower forms of vegetable life, which is not usually included in an elementary book, and more advanced students than those for whom it is intended may learn something from it.

W. B. Grove, B.A.

Correspondence.

The Mildness of the Winter.—I found a bed of *Petasites vulgaris* in full flower, on January 17th; and on March 15th, *Adoxa Moschatellina*, in a wood.—O. M. Feilden.

A Feathered Visitant.—I have had a very curious visitor—a black and white blackbird—in my garden at Stoke. The markings of his plumage were a good deal like those of the magpie, but with rather more white, which was very conspicuous when he was on the wing. His manners and customs, as well as his voice, were precisely like those of the ordinary blackbird, and he had a fine golden bill. He stayed with us two or three weeks, but has since disappeared. I was greatly in hopes that he would have stayed to build his nest.—John Gulson, Coventry, March 6th, 1878.

The Harebell with White Flowers.—Will any botanical readers inform me of any spots where they have seen *Campanula rotundifolia* producing white flowers freely? Is there any connection between the colour of the flower and the soil upon which the plant grows? Last year I found the white-flowered harebell growing abundantly on the mountain limestone between Hartington and Buxton, and again at Breedon Hill in Leicestershire, also on the same rock. Is the white variety constant for succeeding years, and has any one ever met with white and blue flowers on the same plant?—H.

Is the Arum an Insectivorous Plant?—During some rambles last summer I examined numerous specimens of the common plant known as "Cuckoo-pint," or "Lords and Ladies." Without exception I found within the nearly closed spathe a number of small insects, some apparently stupefied, others dead, whilst chitinous fragments of others alone remained. The remarkable appearance of the plant—its spotted leaves and strangely shaped and brightly coloured spadix, are well fitted to attract the attention of insects. Hitherto their visits have been considered chiefly in connection with the fertilisation of the flower, but it is possible that other ends may also be subserved. My only aim in mentioning the matter now is to call the attention of observers to this plant during the coming summer.—H.

Geology.—A interesting deposit of shell-marl, overlaid by peat and a considerable thickness of fine clay, has been exposed in excavations near Leicester. I hope to give particulars in the "Midland Naturalist" at an early date. A minute examination of the interesting series of freshwater shells in the marl and lower part of the peat is now being made. The peat also contains numerous insect remains, whilst the marl is so full of the seeds and stem incrustations of *Chara* as to suggest the probability of its having been formed in great part by this plant.—H.

The Meaning of Knowledge.—Mr. Watson thinks I have unduly limited the meaning of this word; but I have nowhere asserted that it bore *no other* meaning than the one I assigned to it. Like a large number of English words, it has several shades of meaning, most of which are included in my definition. I wished only to point out the incorrectness of its use as a synonym of *belief*, the difference between knowledge and belief being very wide, and the common confusion between them a source of grave and constant error.—F. T. Mott.

Postal Microscopical Society.—Allow me to draw the attention of your microscopical readers to this society, established about four years ago, for the purpose of encouraging the study of such subjects as are best elucidated by the microscope, by sending boxes containing from twelve to sixteen objects that are expected to be mounted by the sender, with an explanation of each. For that purpose a small book accompanies each box in which members write their remarks, explanatory or critical, on the different slides. The present president, Mr. Tuffen West, and Messrs. Underhill, Hammond, Kyngdon, and others, frequently illustrate the objects by excellent coloured sketches; the notes and drawings are in themselves very interesting. The subscription of 2s. 6d., (exclusive of postage, &c.,) and 2s. 6d. admission fee, are the only expenses, except four slides a year from each member to help to fill up the boxes in his circuit. Mr. A. Allen, of 1, Cambridge Place, Bath, the secretary, will, I am sure, be pleased to give every information to enquirers. Cannot our Birmingham friends form a section from among so many excellent microscopists?—Thomas Partridge, M.P.M.S., Stroud.

Botanical Query.—Will you or some of the botanical readers of our Journal oblige by informing me of what use are the "thickened hollow spots" (of Bentham) at the base of the petals of the genus Ranunculus, and whether they occur in any other genera or species?—H. F. Devis, King's Heath.

[These "hollow spots" are what are known as nectaries. Their function is that of secreting the nectar or honey, and they often serve an important purpose in the economy of flowering plants, helping to bring about cross fertilisation; thus, the nectar they secrete is much sought after by many insects, and in obtaining the honey the insect frequently gets dusted with the pollen from the ripe anthers of the flower visited. This it carries away, and in visiting another flower in search of more honey, deposits the pollen carried from flower No. 1 on the stigma of flower No. 2. In this way it unconsciously aids in bringing about the fertilisation of the ovules. These nectaries vary in form, colour, &c.; in Cruciferæ they occur as little green warts at the base of the filaments, in Umbelliferæ they form the fleshy disk at the base of the styles; sometimes they occur as spurs at the base of anthers, as in the violets; again as spurs at the base of the petals, as in many orchids and in the larkspur. They occur as pores at the base of the petals in another of our British plants, *Fritillaria Meleagris*. For full information see Balfour's "Manual" or Sach's "Text-book of Botany," under the head Nectaries.—J. E. B.]

A MICROSCOPIC TRAP FOR A ROVER.—If you would set aside a special corner for Practical Hints in Microscopic Manipulation, I, for one, should turn to it first on opening your journal. We all of us learn something in practice worth recording. Your correspondent S. S. R. has kindly sent me a rich collection, containing amongst others *Hydatina Senta*, (see Dr. C. T. Hudson's, paper 2 M. M. J. 22,) a rotifer which, if it has room for its vagaries, is the maddest of rovers, delighting chiefly in balancing itself on one toe and pirouetting as hard as it can turn in a vertical position! I first tried my usual cell, a ring of microscopic glass, the very thinnest I can get, (and answering to the number 6 on the adjustment collar of the $\frac{1}{8}$th,) with a piece of glass as thin as itself over it. This prevented the whirligig performance, but rest was out of the question, and following even Hydatina's charms under a $\frac{1}{4}$ gets monotonous when you are always *only just catching her up*. So I tried an old idea in a new form. I took a flat glass slide and dropped two Hydatinas on it, with a small drop of water about $\frac{1}{4}$in. in diameter. Upon this drop I laid some *cotton wool*, frayed out so as to be much diluted with (I suppose I ought to say diffused in) space. I then put the thin sheet of glass on that, gave the thin sheet a touch with a needle to set the capillary attraction up, and Hydatina's gambols were over. I used a $\frac{1}{8}$th to examine her easily. The wool acts as a prison to the animal, and a protection from pressure. I had restrained the little beauty as completely as a driver holds a well-broken horse. As the water evaporated a drop added at the side ran in and made all things comfortable again, and I have the two specimens still safe and back in their original bottle. I first tried a trap like this, some years ago, on an animal of extraordinary character. It was related to the *Poduras*, I believe, but I have missed fixing its name—perhaps you can help me to it. It lived in a ditch—gregarious—hopping on the water perpetually, and most difficult to catch, about 1-10th of an inch long. There was no keeping it still a minute, so I improvised, in a deepish glass ring, a forest of cotton wool for it to ramble in, and the effect was most successful—I saw the instrument which gave it its extraordinary power of jumping actually in action. It consists of an enormous stumpy muscular organ, with a round cleft end. It is concealed in, and comes at will in and out of the centre of the under side of the abdomen; it gripped a piece of the wool with the cleft end, pinching it, and then by a violent effort—the exact nature of which I was unable fully to examine—it made its leap. The relative size of the organ, as compared with the abdomen, was something enormous—my notes say as 1 to 3, and it must have been very nearly that. Now, but for my wool trap I should have been quite baffled by both animals, for the compressorium is uncertain and difficult to manage, and, when successful, too often creates unnatural attitudes. I offer these hints with some confidence to your readers, and shall be grateful in return for a few practical hints on my own weak point, which is "light."—F. A. BEDWELL, Fort Hall, Bridlington Quay, Yorkshire. [We shall be much obliged to any microscopical readers who will act on Mr. Bedwell's hint and send us accounts of their methods of manipulation.—EDS. M.N.]

LONDON NOTES FROM AN OCCASIONAL CORRESPONDENT.—Let me congratulate you on the near commencement of the Birmingham Aquarium, and express a fervent hope that the mistake too frequently made of considering the building first, and then consulting the scientific constructor, may not be fallen into, but that the Naturalist shall advise as to the Architect's plans before they are accepted. I am sorry to add that precautions are necessary to prevent the wanton or thoughtless cruelty practised towards the animals by visitors. A short time ago a gentleman was nearly knocked down by an electric eel which he seriously injured; then the

largest crocodile ever brought alive to this country was killed by some one thrusting a stick into its eye, and last week seals were poisoned by fusees thrown into their pond, and one is dead. All this has happened at the Westminster Aquarium within the last three months, and it makes it heartless work when one has to contend against so many difficulties. Cook, who brought over the white whale, left on the 14th for Labrador in quest of others, and may be expected with his treasures in due time.—The Entomological exhibition was a wonderful success, as it deserved to be, since it was the largest and most complete ever held in this country. With 900 cases, repetitions were a matter of course, but there were great rarities, including an unnamed one from the Himalayas, very like *P. Paris*, but, if possible, handsomer; Lord Walsingham's exhibit was the most interesting, and I commend it for imitation to all true lovers of entomology; not only was the perfect insect there, but the caterpillar and pupæ illustrated its progress; and beautiful models of the leaves on which it fed, made of wax paper so admirably as to truly simulate nature, completed the life history, while all were prepared by his lordship himself, who has contrived to invest the caterpillars with most life-like and characteristic attitudes. These are prepared by first killing with chloroform or ether, (not in the cyanide bottle, which destroys the colour,) then making a small perforation near the anus with fine scissors, and rolling with a cedar pencil on blotting paper till the contents are extruded. A blow pipe is next inserted into the slit, and the animal then gently inflated to its natural size, when it is dried on a hot plate or in forceps over a spirit lamp, and the thing is done. It requires skill, and some early failures may be anticipated, but the art is soon acquired, and well repays the trouble. Camberwell Beauties and Purple Emperors, were common enough; and one exhibitor had nearly 7,000 Coleoptera, the work of forty years' collection, at sight of which, I, as a semi-scientific "flaneur," felt (and I hope many more like myself did too) ashamed of my lazy life. There was, too, evidence of the progressive advance of artistic taste among the people, in fifty really exquisite drawings of insects and flowers by a poor working man who had never had a lesson, and whose painting was done by candle light, after work hours. All honour to him. Your old associate, Mr. F. Enock, was there with his microscopic objects, which are obtaining a well-deserved celebrity; his latest success being entire insects mounted without compression; these seen by dark ground illumination are as beautiful as they are instructive.—Let those who keep monkeys beware of overfeeding. Generally the animals die of lung disease, and therefore fat-forming and heat-producing foods are most suitable, but corn flour and sugared milk have just killed the most intelligent Chimpanzee I ever knew, and the *post mortem*, made by Professor Seeley, showed he was loaded with fat, expecially about the heart, which failed in consequence.—W. J. S.

Gleanings.

"On the Detection of Toxic Matter connected with Typhoid and other Enteric Diseases" is the title of a paper read at a recent meeting of the Microscopical Society by Dr. Bartlett. In the course of it he gave an account of his attempts to trace to its ultimate source the cause of a recent outbreak of typhoid fever, and showed that whilst chemical analysis had failed to discover any impurity either in the water or milk, he had been able, by means of microscopical examination, to detect in the water certain bodies, presumably of a fungoid character, which were identical with those found in the bowels of persons who had succumbed to the disease.

West London Entomological Society.—On February 22nd, Mr. Silcock exhibited *A. prodromaria*, *P. pilosaria*, *N. hispidaria*, *A. æscularia*, *H. leucophearia*, and *H. progemmaria*. March 1st, Mr. H. Timms, *N. hispidaria*. March 8th, Mr. Walford, *N. hispidaria* and *H. leucophearia*; Mr. Coverdale, a very dark var. of *H. progemmaria*, the oblique lines on the fore wings being quite invisible. March 15th, Mr. Russell several dark varieties of *H. progemmaria*.

Geological Society.—At the Annual General Meeting, held on February 15th, H. C. Sorby, Esq., F.R.S., of Sheffield, was elected President; and Profs. Bonney and Judd were chosen Secretaries. The medals, &c., were awarded as follows:—Wollaston Medal, Dr. T. Wright, of Cheltenham; Wollaston Fund, Mr. W. J. Sollas; Murchison Medal, Dr. Hans Bruno Geinitz, of Dresden; Murchison Fund, Mr. Chas. Lapworth; Lyell Medal, Prof. Geo. Busk; Lyell Fund, Dr. Waagen, of Vienna.

The Radcliffe Observatory, Oxford.—The Radcliffe Observer, the Rev. Robt. Main, M.A., has just published his Meteorological Observations for 1875. There are two sets of instruments in use in the Observatory; one of the ordinary kind, from which eye-observations are taken by Mr. John Lucas, the excellent and careful assistant; and the other self-registering, by means of photography. The diurnal inequalities of the mean monthly and yearly meteorological elements have been carefully worked out by Mr. Main, as in former years. We note that Moffat's test papers are used for the detection of ozone with apparently good results. The position of some of the instruments seems open to question. Thus, the vacuum solar-radiation thermometer, with blackened bulb, is stated to be "in a niche in the front of the west wing of the Observatory, about 5ft. from the ground;" surely the radiation from the wall must affect it? Such instruments are usually placed on a post, over grass, with the bulb at a height of 4ft. Until uniformity can be obtained in the placing of all instruments, the comparison of observations taken at different places *under different conditions* must be misleading. Why should not a general conference of English Meteorologists discuss these questions, and issue rules by which all observers would, we are sure, be willing to be bound? In an appendix Mr. Main gives very valuable tables of barometric and thermometric heights for the last twenty-one years, and mean monthly rainfall for twenty-five years at Oxford. Altogether the publication is one of great accuracy and interest, and worthily sustains the high reputation of the Radcliffe Observatory.

The United States Survey.—I have just received from Professor Hayden, of Washington, a parcel of the publications of the United States Geological and Geographical Survey for 1877, comprising monographs of North American Rodentia, by Coues and Allen, a thick 4to. volume; Annual Report of the Survey of Colorado, a thick royal 8vo. vol., full of maps and plates and woodcuts; monograph of the North American Mustelidæ, by E. Coues, with twenty plates; Ethnography and Philology of the Hidatsa Indians, by W. Matthews; besides several thick pamphlets, published at short intervals, with outline reports of the work in progress. The immense amount of labour and expense which these five volumes represent, the great value of their contents, and the liberality with which they are presented to such institutions as are likely to appreciate them, deserve the most cordial recognition in all scientific circles throughout the world. Yet it is probable that a majority of the members of the Midland Union are scarcely aware of their existence. I will endeavour at a future time to give some further particulars of the work which is being done by Professor Hayden and his numerous colleagues, and being paid for by the American people.—F. T. Mott, Leicester.

THE HIPPOPOTAMUS, which has been in the Zoological Gardens, Regent's Park, London, since 1850, died on the 11th March.

THE ANALOGIES OF PLANT AND ANIMAL LIFE.—A lecture on this subject, delivered by Dr. F. Darwin, at the London Institution, appears in "Nature," of March 14th and 21st. It will repay careful perusal.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—February 19th, MICROSCOPICAL GENERAL MEETING.—Mr. G. Hookham, M.A., read a paper on "A Method of Preparing Crystals for the Microscope."—Mr. W. R. Hughes, F.L.S., read the first portion of a paper by Dr. Cobbold, F.R.S., on "The Parasites of Man." March 5th, GENERAL MEETING.—Mr. A. W. Wills read the first of a series of papers on "Fresh-water Algæ." March 12th, ADJOURNED ANNUAL MEETING.—The President (Mr. Edmund Tonks, B.C.L.) delivered the Annual Address, the subject of which was "Malaria."—A vote of thanks was given to Mr. Tonks for his address, on the motion of Dr. Deane, seconded by Mr. W. Southall, and supported by Dr. W. Hinds and Mr. W. Wright Wilson.—Dr. A. Milnes Marshall presented a copy of his paper on "The Development of the Cranial Nerves in the Chick."

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY.—February 27th.—Mr. Allen Everitt read a paper on "What to See within Six Miles of Birmingham." In the course of a most entertaining and graphic address, Mr. Everitt described the various old churches, moated and timber dwellings, and ancient farm houses within a radius of six miles The lecture was illustrated by sketches made by Mr. Everitt. March 13th.—Mr. C. R. Robinson read a paper on "The Geology of Ludlow."

BURTON-ON-TRENT NATURAL HISTORY AND ARCHÆOLOGICAL SOCIETY.—March 12th, Mr. R. Thornewill read a paper on "The History of Burton Abbey from the date of its foundation, to the end of the Twelfth Century."

CARADOC FIELD CLUB.—February 25th.—ANNUAL MEETING, held at Shrewsbury—Rev. J. D. La Touche re-elected President; Rev. J. J. Lambert elected Vice-President. Places and dates of Field Meetings for the season fixed on, viz.:—June 26th, Stokesay; July 24th, Abbey-cwm-hir; August 27th, Lilleshall; September 25th, Special Meeting, for Cryptogamic Botany, Downton Castle.—The President gave his address, and a telephone was exhibited and lectured on by T. P. Blunt, Esq.

CHELTENHAM NATURAL SCIENCE SOCIETY.—GENERAL MEETING, February 21st.—The President, Dr. T. Wright, F.R.S.E., F.G.S., gave his opening address. He dwelt much on the natural advantages open to the society in the locality, and the interest each searcher after knowledge would find in studying the geological, botanical, and physical features of Cheltenham and its neighbourhood. He then pointed out, and, by aid of diagrams, explained the general geological features of the hills surrounding the valley.—Mr. H. A. James then gave a full and lucid description of the telephone. An instrument had been fixed in the room, connected with a shop in the street, and much amusement was caused by the messages sent and received.

EVESHAM FIELD NATURALISTS' CLUB.—MEETING, January 30th.—Mr. J. S. Slater read one of the Manchester Series of Popular Lectures, by Wm. Pengelley, F.R.S., on "The Cave Men of Devonshire." February 27th.—Mr. T. E. Doeg delivered an address on "Our Local Molluscs," which he illustrated with some microscopic slides.—The Rev. J. Collins Odgers, B.A., read a paper on the "The Lesser Parasitic Plants," including fungi, mushrooms, and potato mould.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY, NATURAL SCIENCE SECTION—March 13th.—A paper was read by Mr. G. B. Rothera, on "The Physiography of the Yorkshire Coast," illustrated by maps and sections. March 20th.—Microscopical evening. The Rev. G. E. C. Casey, M.A., F.G.S., introduced the subject of "The Epidermal Appendages of Plants." March 27th.—A paper on "Rotifera," part of which appears in our current number, was read by Mr. E. Smith, M.A.

NOTTINGHAM NATURALISTS' SOCIETY.—February 20th.—A paper on "A Feather" was read by Mr. Blandy. February 28th.—The Annual Soirée was held at the Mechanics' Large Hall. There was a very large attendance. Several societies in the Union were represented. There was a good display of microscopes and other objects, including local collections of shells, rocks, birds' eggs and nests, butterflies and moths, &c. At 9.45 Mr. A. H. Simpson exhibited, by means of the oxy-hydrogen microscope, a series of photographs for the lantern. Amongst others was one of the cover of the "Midland Naturalist." Altogether it was a most successful evening. March 6th.—"Life History of a Butterfly," by Mr. C. T. Musson. March 13th.—Microscopical evening, "Insects."

RUGBY SCHOOL NATURAL HISTORY SOCIETY.—February 23rd.—The President read portions of the Meteorological Report. The rainfall of the year was 28·72in., being less than 1876 by 1·9in. Rain fell on 195 days. Papers were read as under :—By Mr. G. Jones on "The Rise, Progress, and Fall of Gothic Ecclesiastical Architecture in England;" by Mr. H. J. Else, on "Campanology;" and by Mr. Percy Smith, on "Mushrooms," in the course of which he described the various edible and poisonous kinds. Mr. Bloxam exhibited two Roman urns and bones found by Mr. E. A. Bird, at Soreham, Cambridgeshire, and described the ancient British, Roman, and Saxon modes of burial. Numerous specimens were exhibited. March 16th.—Mr. M. H. Bloxam, F.S.A., read a paper, full of interest, on "Rugby School Close." Among the exhibits at this meeting were some beautiful specimens of arberescent copper ore.

STROUD NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.—March 12th.—The Rev. W. Farren White, M A., read a most interesting and elaborate paper on "The Slave-making Ant," (*Formica sanguinea,*) illustrated by diagrams and specimens, and a living colony of the species of ants forming the subject of the paper. There was a large attendance.

TAMWORTH NATURAL HISTORY, GEOLOGICAL, AND ANTIQUARIAN SOCIETY.—February 18th.—Mr. F. A. Grayston read a paper on "The Correlation of the Leicestershire, Warwickshire, South Staffordshire, and Shropshire Coalfields." He showed that they were portions of one extensive formation, and gave it as his opinion that probably large deposits of coal and ironstone existed beneath the Permian and Triassic rocks, which, on the surface, separate the coalfields. In support of this view Mr. Grayston stated that the 7ft. coal of that district, and also the strata between that seam and the "Smithy" coal, could be identified in each of the other three coalfields, and that there were many reasons for assuming that the thick coal of South Staffordshire was represented in Leicestershire, Warwickshire, and Shropshire, by the numerous thin seams of coal found there in the upper part of the coal measure series. Several plans and diagrams in illustration of the subject were exhibited. March 4th.—Mr. R. W. Hanbury, M.P., gave a description of his ride through Asiatic Turkey to India, in the course of which much interesting information was given. Mr. Hanbury exhibited a bronze sword, found near Diarbekr, and presented to him by some monks. It is supposed to be the oldest sword in the world. An inscription, in cuneiform characters, cut deeply on the blade, has been translated thus :—"Palace of Vulnirari, King of Nations, son of Pudil, King of Assyria, son of Belnirari, King of Assyria also." Vulnirari reigned between 1390—1350 B.C., and 500 years before David and Solomon. Mr. Hanbury also exhibited several tracings of inscriptions from the walls and stones in many interesting places visited by him on his journey.

Plate I.

Fig 1 × 300.

Fig 2 × 300.

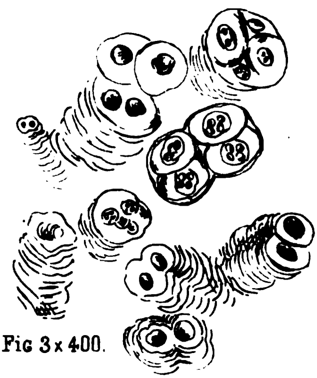


Fig 3 × 400.

Fig 4 × 400.

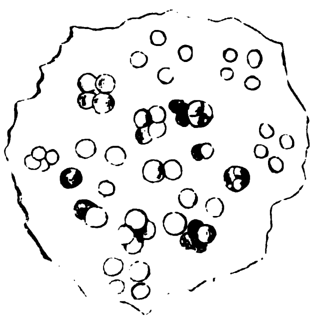


Fig 5 × 200

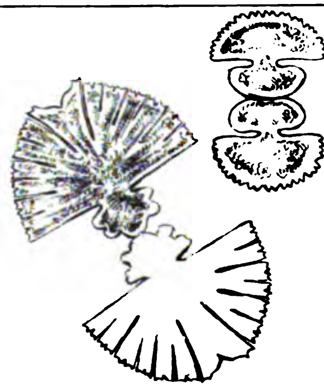


Fig 6 × 100.

A. W. WILLS del et lith

FRESHWATER ALGÆ.*

BY A. W. WILLS, F.C.S.

The objects of the "Midland Naturalist" are, like those of the several societies in the Union which it represents, at least threefold, viz. :—1st, to record such original researches and observations as their members may be fortunate enough to make; 2nd, to facilitate a complete record of the flora and fauna of the several districts of the Midland Counties; and lastly, to enable lovers of Natural History to hold out a helping hand to one another by pointing out how others may pursue most profitably such branches of study as they have themselves specially affected, and by communicating to one another such hints as are derived from their individual experience, whereby success may be ensured, time saved, or gaps in special lines of investigation filled up.

The present paper falls within the scope of the last division; it records little or nothing which is original; its object is to invite attention to a branch of microscopical study in which there is ample scope for observation, and to point out in what fashion the examination of the great group of plants known as the Freshwater Algæ may be successfully begun and carried on.

In doing this it will be convenient to ask and briefly to answer the following questions:—What are Freshwater Algæ, and why will they repay patient investigation? Where must they be sought? What are the general features of their structure, modes of reproduction and morphology, and the characteristics of the principal groups into which they are divided? How are they best collected and preserved? And how should observations be recorded?

1st.—Freshwater Algæ are minute plants, mostly requiring considerable magnifying power to reveal their structure, belonging to that great group of water-weeds included in the somewhat loose term of Confervoideæ or Chlorospermeæ, of which the coarser green weeds of the sea shore are the most familiar examples.

The imperfection of a classification by reference to the colour of these plants or of their spores will become evident from the outset; it must be accepted only as a rough division by which the majority only of the genera are covered.

The freshwater species are far more delicate in texture and various in form than the marine ones, and comprise, in addition to those larger

* Description of Figures.—Plate I.

Fig. 1.—*Chlorococcum vulgare*, from the bark of an ash tree, showing subdivision of cells into groups of two, four, &c.

Fig. 2.—*Protococcus*.—Species allied to *P. pluvialis*, from a freshwater aquarium, showing subdivision of cells and formation of motile forms.

Fig. 3.—*Urococcus* sp? Hass., from damp wall of a greenhouse.

Fig. 4.—*Protococcus* sp?, from wet rocks at Church Stretton.

Fig. 5.—*Tetraspora lubrica*, from bogs in Sutton Park.

Fig. 6.—*Micrasterias rotata* and *Cosmarium cœlatum*, from bogs in Sutton Park, showing increase by cell-division.

filamentous kinds which everyone would recognise as first cousins of the familiar green seaweeds, an immense number of minuter forms, the relationship of which to their more robust kindred is not so evident, and at least two vast groups, totally different in external aspect, rich in the tenderest colours and most exquisite shapes.

But the whole order is especially attractive to the Botanist, not only by reason of its singular gracefulness and beauty, but because in no other can he watch so easily the mysterious fundamental processes of cell-division and of reproduction. "To penetrate everywhere to these first rudiments of structure, to follow out from them the course of the development of the tissues of all parts, and to make out the laws according to which the cell-formation progresses to produce the various arrangements on which the structure of the plant essentially depends, is one of the most difficult, but at the same time most profitable tasks."*

The facility with which these plants can be kept alive for a length of time—often long enough to enable the observer to trace in one individual its entire life-history—the translucency of their cell walls, which lays open to his observation under the microscope the active processes going on within; the many points in their morphology still awaiting solution, and the comparative ease with which they may be preserved for an indefinite period with little loss of their natural form; all these are grounds upon which they possess a high degree of interest, and challenge a more extensive study than they generally receive.

2nd.—Where are the Freshwater Algæ to be sought?

One is almost tempted, from their universal diffusion, to reply, "everywhere." It is, at any rate, safe to answer, "wherever moisture or fresh water is to be found—on the pots and walls in a greenhouse, on the shady sides of tree-trunks, on damp banks, on the moist faces of old walls, in the dripping from water-taps, in every ditch, in the hoof-holes where cattle have trodden in marshy ground, on thatched roofs, in bogs, on moist moorlands; above all, in every clear pool, lake, and mountain tarn, in cold springs and hot springs, floating on the surface of water wherever it is found, clinging as parasites to submerged roots, sticks, or larger water-plants, or entangled among bog mosses and the like."

In describing the principal families we shall revert to their habitats and give some hints as to the signs by which their presence may be recognised.

3rd.—Let us now proceed to consider briefly the principal orders into which they naturally fall, omitting, however, for convenience, that vast group of minute brittle siliceous organisms, the Diatomaceæ, whose vegetable character was so long disputed, and is not even now universally admitted, with which every Microscopist is familiar, inasmuch as their amazing variety of form and the great beauty of their sculptured markings have long caused them to stand foremost among the preparations of dealers and the objects of popular exhibition.

We begin, therefore, with the large and universally distributed division of Unicellular Algæ, which form (with the exception of the

* A. Braun. "The Phenomenon of Rejuvenescence in Nature," p. 122, (Ray Society, 1853.)

Desmidiaceæ) the least conspicuous, but by no means the least interesting member of the family, by reason of the facility which they afford for studying the phenomena of indefinite increase by cell-division.

The obscurity of the characters of these minute forms has led to a reckless multiplication of supposed genera and species; indeed there is little doubt that some of these really represent different stages in the life of the same species or even early stages in the development of higher cryptogams.

The simplest, and at the same time the most widely distributed plant in this order, probably the most universally distributed of *all* plants, is *Chlorococcum vulgare*, the humble organism to which the green colour of the bark of most trees, of old palings, gates, &c., is due. It consists of myriads of minute spherical cells, from 1-1500th to 1-2000th of an inch in diameter, [Plate I., Fig. 1,] in which the process of division of each original cell into two, four, or eight secondary ones, is admirably exhibited. This appears to be the only process by which this species is multiplied, but in that which we shall next consider we shall trace the addition of a further mode of increase which prevails, with some modifications, through many of the more highly organised families of Algæ. This plant, probably allied to the *Protococcus pluvialis* of some writers, appeared some time ago in a freshwater aquarium, and consists of innumerable spherical cells, from 1-1250th to 1-2000th of an inch in diameter, the outer coating of which takes the characteristic blue tint of cellulose when treated with iodine. The inner granular contents are sometimes bright red and at others green. Both forms exhibit the phenomenon of cell-division, giving rise sometimes to a still or motionless progeny, and at others to active zoospores, which move through the water by means of pairs of cilia, or by a single cilium. The relations of these two forms are somewhat obscure, and we have not been able altogether to reconcile our own observations with the statements to be found in books upon this subject. The red cells, at any rate, are capable of lying dormant in a dry state for long periods, the active processes of subdivision being re-established when water is added. Plate I., Fig. 2, represents some of the conditions of this plant. *Protococcus pluvialis* has been elaborately investigated by F. Cohn, whose research is translated in the Ray Society's volume for 1853.

We also give sketches of two kindred species, belonging respectively to the genus *Urococcus*, Hass., [Plate I., Fig. 3] and *Protococcus* [Plate I., Fig. 4.] From these simplest forms there is an easy transition to such genera as *Tetraspora*, in which numerous green cells are arranged in a continuous gelatinous frond, in groups which show very beautifully their repeated sub-division into two and again into four, whence the generic name. *Tetraspora lubrica* [Plate I., Fig. 5] is abundant in summer in little streamlets among boggy ground in Sutton Park,* and is at all times a

* Sutton Park is a property of some 2,500 acres, held under an ancient Charter by the Corporation of Sutton Coldfield, for the benefit of the inhabitants. It comprises woods, moor land, large sheets of water, and clear streams, and, being only seven miles from Birmingham by rail, is the "happy hunting-ground" of the Naturalists of the town and district. Many of its rarer plants and animals have gradually disappeared before the vast numbers of visitors who now frequent it, before recent "improvements," and still more before the railway works which have sorely mutilated the beauty of some of its most charming parts.

pleasing object, especially when viewed by dark back-ground illumination.

A further step towards more complex structure is traced in the nearly allied *Enteromorpha intestinalis*, which, in late summer, forms pale green *tubular* fronds, often a foot long, in similar habitats, and is found in great abundance in warm pools in the "Black Country." Like *Tetraspora*, it is a charming object, especially in a young state, and it possesses further interest, as connecting the marine and freshwater floras, being an inhabitant of salt marshes also, and leading up to several species which are exclusively marine.

To the same order as *Protococcus* belongs that most strange and beautiful of all the lower vegetable organisms, *Volvox globator*, to which the limits of this paper do not allow more than a passing reference. It must suffice to remark that the analogy between *Volvox* and *Protococcus* will be more easily realised by conceiving a number of the green cells of the latter in their motile condition thickly and symmetrically embedded in a larger glassy sphere, with the cilia only protruded.

Volvox should be examined in cells shallow enough to prevent its movement; and by transmitted light, in order to observe its structure; but its most lovely aspect is when it is viewed by powerful dark back-ground illumination in a cell sufficiently deep to allow its exquisite pale green crystal spheres, with their miniature *Volvoces* within, to maintain their swift and graceful rolling motion across the field of the microscope under low powers, when it becomes an object of matchless beauty.

It is not an abundant plant in this neighbourhood. The ruthless and wanton invasion of Sutton Park by a railway, and consequent filling-up of the well-known "Webb's Stews," have destroyed a constant habitat of this as of several other choice plants, as well as the first known locality for the beautiful Rotifer *Melicerta Tyro*, discovered there last year by Dr. Hudson.

The distribution of *Volvox* seems to be capricious, for it often appears in sufficient quantity to render the water pale green, then disappears as suddenly, and perhaps only reappears months or years afterwards.

There are, however, situations in which it appears every year, and where good specimens may be obtained by straining a few pints of the water through muslin, and so, as it were, concentrating the spheres of *Volvox*, which may then be washed off into a small bottle. If it is desired to keep this plant in cultivation, all Entomostraca must be carefully removed with the pipette, as they devour it greedily.

For details of its structure and mode of reproduction the student should refer to the researches of Busk, Cohn, and Williamson, of which a slight summary is given in the "Micrographic Dictionary."

Before passing from the Unicellular Algæ, we must glance at one other large order, which surpasses all others in variety and singularity of form, in perfection of symmetry, and in brilliance of colour—the Desmidiaceæ.

Fortunately they are widely distributed; it is rather the exception than the rule to take up a dip of water from a pool or marsh in which some of the brilliant crescents of *Closterium* or the sculptured discs of Micrasterias do not delight the eye. The most distinctive feature in their appearance is the perfect bilateral symmetry of the two halves into which each plant is generally divided.

The fronds of *Closterium* are more or less crescent-shaped, from the slightly curved form of the Tartar bow to the complete crescent form of the young moon; in *Cosmarium*, *Euastrum*, and *Micrasterias* they consist of thin discs of a more or less oval or oblong shape, deeply constricted in the middle, and with their edges cut, crenated, or sinuated into forms of exquisite beauty and endless variety; while in *Staurastrum* and *Xanthidium* they assume a triangular aspect or have their edges adorned with spines or other appendages.

A glance at the figures in Ralfs' "Desmidieæ," at Plate X. in the "Micrographic Dictionary," or better still, at a few specimens in a friend's microscope, will give the beginner a better idea of their characteristic appearance than any description, and enable him at all times to recognise them among his own gatherings.

These plants rejoice in peaty bogs, where they occur either scattered here and there among larger plants, or in thin films encrusting their submerged stems; or floating in delicate clouds in the recesses of shallow pools, where the eye only detects them when it has become accustomed to the dim light by steadily gazing into the water for some minutes.

From such positions Desmids are best removed by carefully passing a watch glass under them, and raising the contents with slow and steady motion to the surface. Many fine specimens may be obtained also by squeezing out the water from handfuls of clean Sphagnum moss into a shallow basin, allowing a few moments for the plants to settle to the bottom, and then pouring off the surplus water, and transferring the greenish residue to a tube.

Some of the best habitats in Sutton Park have been destroyed by the railway and by drainage, but some of the commoner species, as *Micrasterias denticulata*, *Penium digitus*, *Closterium acerosum*, *C. Dianæ*, &c., and the filamentous species, *Hyalotheca dissiliens*, are sometimes to be found in tolerable abundance in boggy ground by the side of the streams. One morning's search in any bog on a Welsh moorland will, however, yield more and rarer species than any amount of hunting in this district.

It is worth adding that Desmids flourish for years in cultivation in small bottles, exposed to the light of a north window, and their growth can thus be watched *de die in diem*.

The singular modification of cell-division by which they increase will be at once understood from the accompanying figures of *Micrasterias rotata* and *Cosmarium cælatum*, sketched from specimens in the cabinet of the writer. [Plate I., Fig. 6.]

[TO BE CONTINUED.]

PARASITES OF MAN.*

BY T. SPENCER COBBOLD, M.D., F.R.S.

[*Continued from page 99.*]

In addition to the eight Cestodes noticed in my previous communication, all of which belong to the genus *Tænia*, we find the human host liable to entertain several *Bothriocephali*. These are readily distinguished from ordinary tapeworms, not only by the absence of true suckers on the head, but also by the circumstance that the reproductive openings are placed on the ventral aspect of the proglottides, and in the median line. The classification of the Cestodes, as a whole, requires revision, but no zoological arrangement will stand that is not based on the examination of a large number of types. It may be that the out-of-the-way types are difficult to get at and comparatively rare; nevertheless it is just these aberrant types that are wanting to the Cestode systematist. The hard and fast line drawn between the armed tapeworms and the unarmed forms cannot be allowed to remain, since rudimentary hooklets have been found attached to the margin of the supplementary suckerlet or central disk of the beef tapeworm. Of course, as a matter of mere convenience it is very useful to separate the hooked and hookless Tæniæ, but the separation is not fitting as a primary basis of classification. In like manner the snouted or proboscis-bearing tapeworms, (*Rhynchotæniadæ*,) considered as altogether distinct from the tapeworms that do not possess any proboscis or rostellum, (*Arhynchotæniadæ*,) cannot be accepted. Of far more significance and value is the proposal that we should divide the tapeworms into two sub-orders, based on the characters of the egg-shell. This originated with Dr. Weinland of Frankfort. Thus, for the thick or hard-shelled tapeworms, he proposed the term *Scleroleptidota*, and for thin-shelled forms the term *Malacoleptidota*. The eggs of the former require the action of the gastric juice of vertebrates to dissolve their shells, whilst the eggs of the latter readily hatch within the stomach of evertebrated animals, such as mollusks and insects. Quite recently, astonishment was expressed (in the pages of a scientific journal) that herbivorous animals (rabbits and hares) should suffer from the presence of tapeworm. It was evidently unknown to the writer that the larvæ of tapeworms (Cysticerci) are found in many other kinds of food than meat. To be sure, as Melnikow's discovery of the larvæ of *Tænia cucumerina* in the louse of the dog, (*Trichodectes latus*,) amply shows, "measles" are not necessarily swallowed as part of the ultimate host's food, but may be taken into the stomach accidentally. Respecting the question (raised by the President at the last meeting of the Section) as to the temperature necessary to destroy the eggs of tapeworms, I have no special information to offer, but

* Read before the Microscopical Section of the Birmingham Natural History and Microscopical Society, 16th April, 1878. The specimens exhibited by Mr. Hughes on Dr. Cobbold's behalf were *Bothriocephalus latus* and portions of *B. cordatus*; also part of a large maternal hydatid and one daughter-vesicle, together with a microscopic slide, showing the so-called *Echinococcus* heads and hooklets.

ERRATUM IN APRIL NUMBER (p. 98, line 9).—For "muscles in the beast and in the connective tissues," read "muscles in the heart, and in the connective tissues."

it is generally understood that the ova of the *Scleroleptidota* can effectually resist the action of ice and frost. As to the limited powers of resistance to heat possessed by Cysticerci we are now well informed, but I can do little more in this place than refer to Professor Perroncito's experiments and to the enquiries of Lewis, Tommasi, Pellizzari, Giacomini, myself, and others, as set forth in a series of articles published in the *London Medical Record* for 1874. Professor Pellizzari found that measles died at a temperature of 60° centigrade, (*i.e.*, 140 Fahr.) According to Lewis, exposure of the parasites for five minutes to the same degree of heat, or even to 135° Fahr., renders the life of these parasites absolutely extinct.

CESTODA CONTINUED.

21.—*Bothriocephalus latus*, Bremser.

Synonymy.—*Tænia lata*, Luin; *T. grisea*, Pallas; *Dibothrium latum*, Diesing.

Intermediate Host.—The higher larvæ are supposed to reside in fishes, especially salmon and trout. According to Dr. Fock, of Utrecht, the bleak (which is much eaten by Jews in Holland, who suffer from this tapeworm) is probably the intermediate bearer.

Larva.—Scolex unknown; Proscolex, or six-hooked embryo, furnished with long and closely-set cilia.

Remarks.—This worm is abundant in Switzerland, Russia, Sweden, and the north-east of Germany. It occasionally occurs in Ireland, but very rarely in England.

Experiments.—All attempts to rear this worm have failed, although Dr. Knoch, of St. Petersburg, supposed he had succeeded by the administration of the eggs to dogs.

Literature.—Leuckart (l. c.); Heller (l. c.); Knoch, Die Naturgeschichte des breiten Bandwurms, 1862; Sömmer and Landois, Beiträge zur Anat., &c., in Sieb. and Köll. Zeitschrift, 1872; Bötcher, in Virchow's Archiv, 1864.

22.—*Bothriocephalus cordatus*, Leuckart.

Syn.—*T. vulgaris*, Linn., Pallas.

Larva.—Unknown.

Int. Host.—Probably marine fishes.

Remarks.—This species is about a foot in length and is very abundant in the dogs of North Greenland. It occasionally infests man. The head is somewhat heart-shaped, and set on to the strobile without any neck or narrow segmentation intervening.

Lit.—Leuckart, Die mensch. Par., Bd. I., s. 438, 1863.

23.—*Bothriocephalus cristatus*, Davaine.

Syn.—None.

Larva.—Unknown.

Remarks.—This species is of moderate length, (8ft. to 10ft.,) and comparatively narrow. It is distinguished by the presence of a crest-like rostellum. It has twice been found in France. The Westminster Hospital Museum contains some tapeworms probably referable to this species.

Lit.—Davaine, "Les Cestoïdes," Dictionnaire Encyclopédique des Sciences Médicales, (p. 589,) 1874.

Although the last-named species closes the list of human tapeworms, properly so called, yet no record of the Cestodes of man can be considered

complete without taking into account the occurrence of hydatids. These structures, often spoken of as bladderworms, form, as is now well known, the scolex condition of a minute tapeworm *(Tænia Echinococcus)* which lives in the dog. From a sanitary and professional point of view this parasite is of more importance than all the others put together, but it must be obvious that it would be out of place here to do more than glance at its strictly zoological position. Every experienced Surgeon has to deal with instances of its occurrence in important organs, and probably not less than four hundred persons perish in the United Kingdom every year from this worm. In Australia and in Iceland the echinococcus disease is excessively fatal to man. The parasite is also scarcely less frequent amongst animals, although in these bearers its presence is only rarely attended with fatal consequences. Zoologically and morphologically the common hydatid is of great interest. Whilst the sexually mature worm supplies us with a form of human tapeworm altogether unique, (both as regards its size and the small number of its proglottides,) the larva, in the character of an hydatid, presents us with a type of polycephalous bladderworm which, so far as I am aware, has no parallel. The hydatid furnishes us also with a curious illustration of the extreme possibilities of tapeworm multiplication from a single germ. Starting with the postulate that the sum total of the products of a single impregnated germ or ovum fairly represents the "individual," (zoologically, so to say,) we find that whilst, on the one hand, the egg of any ordinary tapeworm begets only one Tænia, the egg of the hydatid-tapeworm is capable of producing, under favourable circumstances, several thousand tapeworms. To appreciate this truth, it is only necessary to observe that the six-hooked embryo becomes one hydatid. This maternal bladderworm may by proliferation beget daughter and grand-daughter hydatids, all of which in their turn may give rise to the formation of echinococcus heads in their interior. Separately these so-called heads represent as many tapeworms, and collectively they amount to many thousands. Thus, when a dog or wolf swallows the polycephalous hydatid and its offspring, all the heads of the colony of larvæ or scolices will become connected into sexually mature tapeworms in the intestine of the new host. The zoological individual, therefore, will comprise not merely one tapeworm, but a multitude of tapeworms. In other words, whilst the egg of an ordinary tapeworm like *Tænia mediocanellata* supplies a single colony or strobile of 1,200 joints, (proglottides or zooids,) the egg of the little *Tænia Echinococcus* supplies several thousands of colonies or strobiles, each of which is made up of three segments, without reckoning the head. This singular mode of tapeworm multiplication is also witnessed, though in a much less degree, in certain other forms of polycephalous bladderworms.

24.—*Echinococcus hominis*, Rudolphi.

Syn.—*E. veterinorum*, Bremser, Gurlt, &c.; *E. scoliciparienš* and *E. altriciparienš*, Küchenmeister; *E. polymorphus*, Diesing; *Acephalocystis*, Laennec, John Hunter, Owen, &c.; *Polycephalus*, Goeze; *Hydatis*, Lüdersen; *Hydatigena*, Batsch; *Vesicaria*, Schrank.

Adult State.—*Tænia echinococcus*, Von Siebold.
Ultimate Host.—Dog and wolf.
Remarks.—Forms three well marked types of hydatid growth, known to pathologists as exogenous, endogenous, and multilocular varieties (*E. multilocularis*, Virchow.) The liver is the organ most frequented. Thus, in 327 cases collected by myself, 373 by Davaine, and 983 by Neisser, giving a total of 1,683 cases, the average of liver cases was very nearly 46 per cent. Hydatids probably prove fatal in 25 per cent. of all the persons attacked. In Iceland they are the cause of one-sixth of the annual mortality.
Literature.—All standard works on helminthology, especially those of Leuckart and Davaine. The best monograph is that of Dr. Albert Neisser (Die Echinococcen-Krankheit; Berlin, 1877).

[TO BE CONTINUED.]

SCIENTIFIC NAMES.—I. FORM.

BY W. B. GROVE, B.A.

At the first birth of modern science, the names which it employed were generally, though not universally, formed in accordance with the recognised rules of the classical languages, but later times, when an acquaintance with the classics is no invariable preliminary or accompaniment of scientific discovery, have given birth to a number of words, which are unclassical either in their form or their origin. This may not be a matter of much regret, since science flourishes equally well, whether its terms are of legitimate or barbarous formation, but on the other hand the attempt at accuracy in this respect can scarcely do it any injury. One might justly think it unworthy of a scientific man to descend to the level of the draper who manufactures "*pectus expandus*" braces, or the shoemaker who invents "*pannus corium*" leather. In the report of an establishment for the training of Naturalists, not long ago, it was said that those students who had previously received a classical training were always the least exact in their biological work; but it is by no means certain that this result was owing to their previous study. In fact, since accuracy is to a great extent a habit, which, like other habits, can be acquired, it would seem likely that those, who were most accurate in one study, would be so in any other in which they were equally interested.

The following remarks are meant for those who feel the want of some help and guidance in the matter of scientific nomenclature; but the subject is so extensive that only a small part of it can be touched upon here. What is to be said will be divided into two parts, the first concerning the form, the second concerning the pronunciation of scientific names. It is understood, of course, that the dictionary and lexicon can be consulted, when necessary, by the investigator; this is an essential requisite, but one in which there can be little difficulty, in these days of libraries, for any one. Most of the words, however, are not in the dictionary in their complete form, but require to be looked out

piecemeal, and it is in this part of the work that help will be most needed. We must begin with a little elementary information.

In inflectional languages most of the words consist of two parts, (1) that which contains the root-idea or ideas, which is called the stem, and may itself be composed of more than one part, and (2) a termination, which has generally no meaning apart from the stem to which it is affixed. The termination may consist of one or more letters or syllables. An important rule is, that in all cases the stem of all the derivatives from any word should contain the *true* root of that word, which is sometimes not obvious. To illustrate what is meant, we will take the word *chroma*, the nominative case of a Greek word meaning "colour." The true root of this word is *chromat-*, the *t* having been dropped from the nominative case, and when the Greeks wished to form a derivative from it, they would always use the true root as a stem; so they obtained *chromat-icos*, "relating to colour," from which we get *chromatic*, and we have also *achromatism* and *chromatography*. These are correctly formed, but when Vauquelin, in 1797, discovered a new metal, the compounds of which were remarkable for their varied colours, he called it *chromium* instead of *chromatium*, as it should be. More recently the coloured envelope of the sun has been called the *chromosphere;* it ought to be *chromatosphere*, and the reader may recollect the outcry which was raised against the word on this account at its first introduction. The generic name, Stromatopora, from *stroma*, is an instance of correct formation in a similar case. In the two instances just given the misformed words are firmly established, and a change is not only improbable, but perhaps not even desirable. But this is by no means a reason for forming fresh words incorrectly, and there are cases where two modes of spelling exist, when it becomes a question which should be preferred. Thus, there is a botanical genus Portulaca; of this word Portulac- is the stem, and *-aceæ* is the termination used to denote the whole assemblage of plants of which Portulaca is the type, consequently this Natural Order should be called Portulac-aceæ. In Balfour and the London catalogue this is done, but Bentham and Babington give the title as Portulaceæ, the second *ac* having been dropped. There is another genus Dipsacus, of which Dipsac- is the stem; its Natural Order should, therefore, be Dipsac-aceæ, and it is so given by Balfour and Babington, but the other two authorities unite in writing it Dipsaceæ. I am aware that there exists a possible explanation of this anomaly, in supposing the termination in these cases to be only *-eæ*, but it ought certainly to be *-aceæ*, and the explanation will not apply to the following case. The Natural Order containing Berberis should be named Berberid-aceæ, because the stem of the former word is Berberid-, as is seen in the analogous cases of Orchidaceæ from Orchis, Iridaceæ from Iris, and many others. Here Balfour, Babington, and Bentham agree in using the true stem, but the London catalogue gives Berberaceæ. It is a case of "doctors disagreeing," but a knowledge of the principles underlying these instances will enable the student to "decide" which doctor it would be better to follow. The tendency is evidently to drop syllables which seem to be superfluous. There is a curious instance of this in a branch of science, in which brevity of nomen-

clature is not now studied, in the name of *formic acid.* This acid was first obtained from the red ant, *(Formica rufa,)* and should have been called *formicic acid.*

There is one rule, which seems to be well established, and deserves particular notice, as it appears to conflict with that laid down above. In such words as Distoma and Leptothrix, the last components *stoma* and *thrix* are used in the nominative case, which does not here show the true stem. The reason is that no termination has been added in these cases: when, however, that is done, the true stem ought to appear, as in Distomatidæ (erroneously written Distomidæ) and Leptotrichum. It is, indeed, impossible to insist absolutely upon obedience to these rules; euphony must be consulted, and will occasionally give the preference to the less correct form. Moreover, the ancients themselves sometimes failed to observe their own precedents. Thus from *lapis,* (stem, *lapid-,)* "a stone," they obtained *lapicida,* "a stone-cutter," after which Linnæus named *Helix lapicida;* but from those who know what it ought to be it requires an effort not to write *H. lapidicida,* as has been in fact sometimes unconsciously done.

It may be useful to give an epitome of the chief Latin terminations, with the rules concerning them, so far as they concern our purpose. The genitive case, which answers to our possessive case, and means "of (a thing,)" is given as well as the nominative, because it is often required, as will be seen further on. In Latin, nouns are divided into five classes, called declensions, but only the first three of these are important to us, words belonging to the others being very rarely met with. Those belonging to the first declension end in *-a* and *-e*, and are feminine, or in *-es*, and are masculine; those of the second in *-us* and *-er*, and are masculine, (except names of trees in *-us*, as Fagus, which are always feminine,*) or in *-um*, and are neuter. More than two-thirds of the nouns used in scientific nomenclature belong to these declensions: these are, therefore, the most important, and are also the easiest to understand.

NOUNS.

	Singular.		Plural.		Examples.
	Nom.	Gen.	Nom.	Gen.	
I.	-a, *f.*	-æ	-æ	-arum	*rosa*, a rose, *rosæ*, roses.
	-e, *f.*	-es			*crambe*, a cabbage, *crambæ*, cabbages.
	-es, *m.*	-æ			see note†
II.	-us, *m.*	-i	-i	-orum	*rubus*, a bramble, *rubi*, brambles.
	-er, *m.*	-ri	-ri	-rorum	*liber*, a book, *libri*, books.
	-um, *n.*	-i	-a	-orum	*cilium*, an eyelash, *cilia*, eyelashes.

The method of applying this and the following table is as follows:—Take away from the word the letters given in the first column; what remains is the stem, and to it must be added the respective letters given in the other columns. There is one exception; in words ending in *-er*, the *r* forms an essential part of the stem. As examples we may take *fungus*, a mushroom, *fungi*, of a mushroom, *fungi*, mushrooms, *fungorum*, of mushrooms, *fung-* being the stem; but in *liber*, a book, *libr-* is

* The chief example of a non-feminine name of a tree, (except those ending in *-um*,) is Acer, a maple, which is neuter, *e.g.*, *Acer trilobatum*. Names of large shrubs, or even of small trees, ending in *-us*, as Euonymus, are made feminine or masculine according to taste; thus we meet with both *Euonymus Europæa* and *Euonymus Europæus*.

†To this class belong the numerous generic names ending in *-ites*, as Phragmites, Ammonites, Peronosporites, &c.

the stem, as in library. The knowledge and application of these few facts alone would save many a blunder which now appears even in print. For instance, one of the commonest mistakes, so common that the Rev. M. J. Berkeley mentions it expressly in his "Outlines of British Fungology," is to say "a Fungi." By what has been said, it will be seen that Fungi is the Latin plural of Fungus; it is as correct, therefore, to say "a Fungi," as it would be to say "a Funguses." One great source of error is the fact, that the singular of the first declension and the neuter plural of the second have the same ending *-a*. But to decide to which of these a word ending in *-a* belongs, it is only necessary to consider whether it is singular or plural. This would prevent such mistakes as to use ciliæ as the plural of cilia; so with septum and septa, infusorium and infusoria, phytozoön and phytozoa. The non-existent words *infusoriæ* and *phytozoæ* may be seen in well-known chemical and botanical handbooks respectively.

Generic names are always nouns, and their gender, consequently, is invariable; specific names are mostly adjectives, and can then vary in gender, but otherwise they resemble nouns.

ADJECTIVES.

Singular.			Plural.		
m.	*f.*	*n.*	*m.*	*f.*	*n.*
-us	-a	-um	-i	-æ	-a
-er	-ra	-rum	-ri	-ræ	-ra

In the classical languages it was the rule that an adjective must agree in gender, number, and case with the noun to which it refers. Compare *Raphanus maritimus*, *Crambe maritima*, and *Alyssum maritimum*. Consequently, when a species is transferred from one genus to another of different gender, an adjectival specific name must be altered, if necessary, to correspond. Thus there is a plant called *Leontodon hirtus*. From this we see at once that Leontodon is masculine; but the plant is sometimes placed in the genus Thrincia, which is feminine; its name must then be *Thrincia hirta*. Some of the first men of science have occasionally neglected this, and produced monstrosities, by the side of which the botanist's pet name for a common roadside weed, *Dockia roadsidum*, would not appear utterly disreputable. It will be noticed that adjectives ending in *-er* generally drop the *e* in the other genders, as *Orobus niger*, *Sambucus nigra*, (because the elder is a tree,) *Solanum nigrum;* but those ending in *-fer* and *-ger*, as well as *asper* and *lacer*, retain the *e*, as *Sonchus asper*, *Chara aspera*, and *Gastridium lendigerum*. Most of the names of the large divisions of the animal and vegetable kingdoms are adjectives, agreeing with some noun understood. Thus, nearly all the names of the Natural Orders of plants are feminine plural, agreeing with *plantæ*, plants, and those of animals, (except fishes,) neuter plural, agreeing with *animalia*, animals. Examples are Cruciferæ, cross-bearing plants, and Rotifera, wheel-bearing animals. Young students almost always forget the fact that these are plural, and talk of "a Ranunculaceæ," "a Polyzoa," &c., which are as bad as "a Fungi." There is sometimes a difficulty in finding a suitable English singular for these words, but it must be done, and can be done in various ways, as a ranunculaceous plant, a crucifer, a polyzoon, a rotifer, and so on.

[TO BE CONTINUED.]

FRESHWATER LIFE.—II. ROTIFERA.

BY EDWIN SMITH, ESQ., M.A.

(*Continued from page 96.*)

I do not propose any elaborate description of examples, and shall merely mention, with a few notes, those which have occurred to me in the neighbourhood of Nottingham, and which are tolerably common everywhere. I have of course met with our old friends *Œcistes*, *Floscularia*, *Melicerta*, and other sedentary or case-inhabiting kinds. According to my experience, the sheath of *Œcistes* is generally of an irregular, somewhat broken form, and more or less dingy with adhering vegetable matter. Last March I found one with three eggs at the bottom of the sheath, close to the supporting stalk. *Floscularia*, with its long pedicel, might easily be taken at first sight for a large Vorticella. Round the opening at the free extremity, there are five, or occasionally six, knob-like processes, each armed with a radiating bundle of long cilia, finer than any spun glass. These long filaments, however, have no concern in producing currents towards the mouth; such currents being evidently due to vibratile cilia within the mouth or gullet itself. The species which I have most frequently met with is, *F. cornuta*, distinguished by a little horn or feeler at the back of one of the knob-like processes. The eggs cluster in a group of two or three about the pedicel; and through their thin covering may often be seen the eye-spots of the young ones. The outer sheath is perfectly transparent, and has a refractive power nearly the same as that of water. Consequently it is almost invisible, except by means of particles collecting on its delicate surface. *Melicerta* possesses a ciliated disk, arranged in wavy lobes, presenting a front aspect not unlike the stylish cap one sees in portraits of Mary Queen of Scots. Nothing can exceed the beauty of the general effect, when this graceful wreath is in full action. Still more noteworthy is the animal's building talent. Into a little pit near the head, particles of selected matter are swept from the water, and there moulded into conical pellets, which the animal then deposits in regular courses one upon another, like rounds of bricks, and so builds up its case. These cases, of a reddish brown colour, are easily detected with the naked eye, attached by one end to branches of myriophyllum, or roots of lemna. By clipping out the bits of vegetation to which the several specimens cling, four or five may be got together in the field of a two-thirds objective; and then the display, under spot-lens illumination, is simply magnificent. A zoophyte trough made specially shallow from front to back, is the most convenient for showing them. With regard to *Stephanoceros*, or the Crown-horned Rotifer, it should be noticed that the lobes of the wheel-apparatus take the extreme form of so many tentacles, fringed with whorls of moving cilia. The protecting case is highly transparent. Few specimens have rewarded my search in this neighbourhood.

We now pass from those kinds which envelope themselves in a sheath of various structure, into which they can retire at will, to the free-swimming group. The latter constitute by far the larger division of

Rotifera. Occasionally the observer is startled by seeing move across the field of his microscope a thing with long stiff outstretched tail, like a mouse; and he can hardly believe that he is looking at a creature only the 120th of an inch long. It bears the expressive name of *Monocerca rattus*, or Rat-single-tail; the tail being, as already explained, a sort of foot prolonged backwards. This species may be looked for among duckweed in the earliest days of spring, and all through the summer months. Closely allied to it, if not of the same genus, is *Mastigocerca carinata*, or Keeled-whip-tail; whose chief distinction is a dorsal expansion of the integument, like a keel. The body is about the 160th of an inch long by about the 400th of an inch broad, inclusive of the keel. It has a crimson eye-spot, and is found among confervoid plants.

I well remember the pleasurable surprise with which I saw for the first time, in the month of May, a fine example of *Notommata tigris*, so called from having its eye-spots situated on the back of the neck. It may easily be recognised by its long pair of forceps, or double setæ of the tail-foot, the longer blade being the 120th of an inch in length, nearly twice as long as the body. I noticed numerous transverse lines on the thinner half of each seta, about fourteen on the longer, and eight on the shorter of the two. These quasi-jointings evidently contributed to the flexibility of the organ. The outer cuticle of the body was soft, and allowed the most varied contortions on the part of the animal. On one occasion, in the month of June, I observed in some water taken from a small pond in our Arboretum, an egg covered all over with hairs. I watched the egg for some hours in a live-box. The enclosed animal fidgetted about in its narrow prison, and appeared to be rasping the membrane at one end of the egg. The crimson eye-spot was beautifully distinct. At last the shell was broken through, and the tiny prisoner struggled into freedom. In a few moments it unfolded its limbs from their doubled-up posture, and sailed merrily away, unmistakably a young *Scaridium longicauda*. As its name, Long-tailed-leaper, implies, the Scaridium can leap as well as swim. It leaps with the aid of its tail-foot, which attains the considerable length of the 90th of an inch, the body measuring only the 137th of an inch.

It is a good plan for the microscopist to make drawings for future reference of everything noticeable which he meets with. Referring to my notebook, I find sketches of the ventral and posterior aspect of what I take to be *Euchlanis triquetra*, although Pritchard fails to notice the lateral fissure between the upper and lower valves. The body-shield, seen from behind, looks like a three-cornered hat. It evidently consists of three valves, two dorsal rising in a ridge along the middle and divided by a deep furrow, and one ventral, separated from the foregoing at the sides. There is also a large opening behind, extending some way on the under surface, and giving liberty to the tail-foot to double up beneath the ventral valve. My first observed specimen happened to lay an egg while under examination. The egg was the 190th of an inch long, the length of the parent's body being the 80th of an inch. A near relation of Euchlanis is *Salpina*, a very common object in freshwater gatherings. The lorica is three sided, with a dorsal ridge furrowed from end to end.

The front and hinder extremities differ in different species. *S. mucronata* has a lorica furnished with four spines in front and three behind; *S. ventralis* has two in front only, and its lorica is spotted. On the back of the neck of the former will be found a feeler, armed with a bristle. The body of a full-grown Salpina is about the 100th of an inch or more long. A young one has just the reeling side-to-side motion of its parent, but has a soft lorica, which becomes hard and firm with age. Our next example is one which occurred to me in a gathering from the small Arboretum pond before mentioned. *Dinocharis pocillum* has the basal portion of its tail-foot freely jointed, the joints having spinous processes. There are also two spines near the origin of this organ, and a minute bristle marks where the fork begins. The lorica is rather loose, and stippled all over with open dots. The actions of the animal are queerly angular and vigorous. One of the most beautiful of the loricated Rotifera is *Stephanops lamellaris*, in which the body-shield undergoes a peculiar expansion on its anterior margin, so as to form a very elegant crown over the animal's head. Behind the lorica is armed with three spines, and there are three bristles at the end of the tail-foot. On each side of the head is a little horn, and the neck has a collar-like thickening. The entire length of the lorica, including spines and hood, is about the 200th of an inch. A familiar friend to the microscopist is *Squamella oblonga*. Its favourite occupation is to climb about the stems or roots of water-plants, feeding as it goes like a minute species of cattle. It has four crimson eye-spots, and a lorica armed in front with four small spines.

One of the most interesting of all the free swimming Rotifera is, undoubtedly, the little creature which has given its name to the order, and is known as *Rotifer vulgaris*. When the wheel-like apparatus is drawn in, the shape of the animal reminds one of a spindle, the forward extremity tapering, as it were, into a blunt-pointed snout. Its movements are then much like those of a leech. The body is alternately wrinkled up telescopic-fashion, and stretched out over the ground intended to be covered. The ciliary wreath is double, and serves both for swimming and feeding. On the back, near the head, is a small feeler. There are two eyes, placed much in advance of the masticatory organ, and, apparently near the tip of the snout, in the retracted state of the ciliary wreath. I was very much puzzled, some years ago, when, having caught a full-grown female specimen, I observed a young one, about half her length, freely disporting itself in the interior of its parent. Omitting the parent's tail-foot, about two-thirds of her body was occupied by the young one, with eyes, and champing gizzard all complete. Even the ciliary wreath of the latter played at intervals. And all this must have taken place in the maternal ovary, which had been stretched to accommodate the offspring for some-time before actual birth. In fact the common *Rotifer* is occasionally ovo-viviparous; that is to say, the young, though produced from eggs, may be retained within the ovary for a certain time after they are hatched.

In *Brachionus urceolaris* the lorica is closed at the sides and open at the ends like the shell of a tortoise. Into this the animal can entirely

withdraw itself. It is very prolific, and sometimes increases in such numbers as to render the water turbid. The terminal forceps of the tail-foot can be drawn back into a sheath. Both the front and hinder edges of the body-shield are usually toothed. I have often seen this majestic creature, with from two to four eggs attached to the hinder part of her body, sailing about as if proud of her maternal charge. She thus tugs along a precious load of care through a large portion of her existence; while the crimson eye of the parent is prettily imitated by the tiny eye-spots of her yet unhatched offspring. My last example, *Pterodina patina*, is found lurking under the leaves of duck-weed. Its generic name refers to certain wing-like processes; its specific name aptly describes the dish-like form of the soft, flat, transparent lorica. The tail-foot comes out through an opening in the lorica near the middle of its ventral surface, giving the creature a profile somewhat like a shield with its handle. The free extremity of the tail-foot acts like a sucker, enabling its possessor to hold on to one spot, while swinging round with the rest of its body, an exercise which it seems to enjoy. Owing to the transparency of the body-shield every internal organ can be discerned with ease. The convolutions of the respiratory canals are particularly well shown. Two longitudinal muscles can also be seen, crossed by faint striæ.

In bringing my imperfect observations upon Rotifera to a close, I take the opportunity of strongly recommending to the student, as books full of interesting information and excellent figures, Slack's "Marvels of Pond Life," and Gosse's "Evenings at the Microscope."

Reviews.

British Barrows: a Record of the Examination of Sepulchral Mounds in various parts of England. By Wm. Greenwell, M.A., F.S.A. London: Macmillan and Co. Price £1 5s.

Canon Greenwell's "British Barrows" is not only the most important contribution to Archæology which 1877 produced; it is one of the most accurate and philosophic works which have yet appeared on the pre-historic branch of the science. We use the term "pre-historic" in that convenient, if rather loose sense, which applies it to the times after the Palæolithic age, and before the dawn of history. No single book has added so much to our knowledge of the Neolithic and Bronze periods. As a record of actual exploration it has few equals, as a comment on discoveries it has hardly a rival. The introduction is a compendious statement of what is known and what can be inferred respecting the unrecorded past. Many of the older books on Archæology are so obscured by fanciful or traditionary notions that the facts they contain lose much of their value. An antiquary who started on his explorations expecting to disentomb an Ophite temple, a Druidical altar, or a monument of King Arthur, unconsciously distorts his discoveries to fit in with his expectations. Other archæologists, avoiding the Scylla of fancy, have fallen into

the Charybdis of bald fact. Messrs. Bateman and Carrington, for instance, aspired no higher than writing a journal of barrow-opening, and though "Ten Years' Diggings" and the "Vestiges of the Antiquities of Derbyshire" are most useful storehouses of information, it is manifest that many little matters of importance either escaped notice, or were unrecorded through their avowed disregard for any theory. Canon Greenwell's review of facts, and the deductions from them, written as it is with a knowledge of most that has been done by others, is both a key to his own work and a fairly complete epitome of the science.

The plan of the book is as follows:—First there is an "introduction" which contains the general review of fact and theory we have just referred to. Next is an account of the author's own work, the thorough examination of 234 tumuli or burial mounds. Nearly three-fourths of these (the actual number is 162) are or were in Yorkshire, the East Riding containing the great majority. The remainder belong to the counties of Cumberland, Westmoreland, Northumberland, Durham, and Gloucester. The concluding pages are occupied by Professor Rolleston's description of the skulls and his observations on them, with an appendix on the pre-historic fauna and flora.

The introduction and the appendix are not the least valuable parts of the book. We have already stated the high estimation in which the former must be held. But of course all the conclusions of the authors will not meet with general acceptance. Now and then an imperfect acquaintance with well-known facts is disclosed. "British Barrows" does not profess to be a full account of pre-historic Archæology. The complete text-book of the science has yet to be written. As an instance of oversight, one case will suffice. Every practical barrow-digger knows that the ordinary "rat" of the tumuli is the *Arvicola amphibia*, and will feel surprise that Prof. Rolleston seems to consider the fact a discovery. This little creature is so constant a member of the barrow-fauna that it has been said by one of our greatest practical archæologists to be the invariable comrade of the human tenants of the tumuli. Again, in the majority of cases, the water-rats' bones were certainly not carried into mounds by a pole-cat, as Prof. Rolleston supposes. Their calvariæ are usually intact, and there can be no doubt that the animals lived and died amidst the loose stones of the cairn. Their abundant presence is a strong testimony to the humidity of the climate in ancient times. But such a shortcoming as this is after all insignificant, and the mention of it as a fault will show how few grave errors are to be found in the book.

Turning to weightier matters we cannot altogether concur in the doubt Canon Greenwell expresses as to whether any of the round barrows are of the Neolithic period. The long barrows have been almost universally attributed to this æra, and the author's conclusion as to his own work, (including fourteen of these mounds,) and the work of others, is that these tumuli belong to a time antecedent to a knowledge of metal. The round barrows, however, he seems at the outset to class as all belonging to the Bronze period; though he afterwards qualifies this view, and, indeed, almost commits himself to the opposite opinion. There can, we think, be but little doubt that a Neolithic period existed in Britain, just

as it certainly did in Denmark and Switzerland. And we strongly incline to Canon Greenwell's maturer conclusion that many of the ordinary bowl-shaped mounds belong to it. Apart from all other indications, the comparatively brief endurance of the Bronze age and the great number of the round barrows lead one to conclude that these tumuli could not all have been piled up in so short a time. A period estimated as lasting for only 700 years could hardly have witnessed the accumulation of nineteen out of twenty of the pre-historic cairns.

Canon Greenwell confirms the opinion that no differences of custom can be traced between the people of the Bronze age and those of the Neolithic age. His Yorkshire evidence agrees with the result of the Derbyshire explorations, viz., that there is no reason for supposing that the practice of cremation was a funeral rite distinctive of the Bronze period. Inhumation was equally in vogue. All the evidence goes to show that the general adoption in any particular district of one custom or the other was either a tribal peculiarity, or a superstitious ceremony, or (perhaps more probably) the result of circumstances. Inhumation was the rule on the Wolds, where a tree is now a rarity, and wood must have always been scarce. Cremation was generally practiced in Cleveland, where the different nature of the soil would admit of the growth of timber. It cannot be said of course that the adoption of cremation was wholly dependent on abundance of fuel, but it was probably one of the determining circumstances. Indeed, each addition to our knowledge seems to show that in very early times races and customs were mixed, and that social improvement took place amongst peacefully mingling races, rather than from conquering invaders. Not that there was peace in the land: tribe fought with tribe, and many a hill-fort now-a-days marks the scene of desperate conflicts of old. But modern research has destroyed the notion that such a momentous change as the introduction of metal was brought about by an exterminating swoop of a foreign and superior race.

Canon Greenwell makes it clearer than ever that natural conditions will account for many divergences of habit. In Derbyshire, where stone is abundant, nearly every interment is protected by a cist, a rude chamber constructed of rough stone slabs. On the Yorkshire Wolds, where such slabs must have been brought from a distance, cists are almost entirely wanting. The greater frequency of bronze in the southern counties is doubtless due to the opportunity of dealing with the Phœnician traders, though on the other hand, and curiously enough, the Wold dwellers seem to have been poorer in jet and amber decorations than many of the inland tribes.

The exact significance of depositing articles of value with the dead is not advanced towards certainty by Canon Greenwell's book. The difficulty is that the custom existed, but by no means to a sufficient extent to equip the deceased for the supposed requirements of the future life. The gift to the departed must be looked upon as symbolical, rather than as intended for actual use, and this view seems borne out by the practice of placing vessels, which doubtless contained food, with the ashes

of those whose bodies had been burnt. Everything points to the observance having a superstitious origin. The traditional veneration for stone, once the material of the most highly-prized weapons, long outlasted the uses of flint and quartzite. Flint flakes are found in Roman tombs. Even in the middle ages a person outside the Christian pale was buried with pagan rites, in observing which flints and pebbles were cast into the grave. Canon Greenwell quotes the priest's speech from "Hamlet," to which Mr. Carrington called attention in "Ten Years' Diggings," where, speaking of Ophelia's burial, he refers to this remnant of pre-historic customs.

We regret that space prevents our making our readers better acquainted with this interesting book. Its style is good, its descriptions vivacious. It is with regret we leave it, hoping that our observations on it may lead to its being carefully studied. The accuracy of general results, (which are all that can be discussed within the scope of a short review,) can only be tested by examining the accounts of actual work. These, which form the bulk of Canon Greenwell's volume, will be found models of care, both in barrow opening and in note making. We may add that the book is illustrated by some capital woodcuts of the pottery and implements, &c., unearthed.

ROOKE PENNINGTON.

Adventures in the Air, being Memorable Experiences of Great Aeronauts. From the French of Wilfrid de Fonvielle. Translated and Edited by JOHN S. KELTIE, with numerous illustrations. London: Edward Stanford. Price 6s.

Mr. Keltie, a gentleman who, as many of our readers are aware, is a member of the editorial staff of *Nature*, has supplied a real want in our literature, by presenting this excellent work in an English dress. Though it does not profess to be a complete history of ballooning, but simply a collection of the more notable incidents that have marked the progress of the science and practice of aeronautics, it will be found to contain very full information on the subject. It is based on M. de Fonvielle's "Aventures Aériennes," but is not a mere translation. Some passages of interest only to French readers have been omitted and several additions made, bearing mainly on the history of ballooning in England. The volume has had the benefit of M. de Fonvielle's revision, and he has added details, embodying the most recent information. Mr. James Glaisher, F.R.S., has also assisted in the work of revision, and Mr. Coxwell has supplied some particulars to the portion of the volume in which he is referred to. For lack of space we cannot enter into details of the contents, but we can, and do, warmly recommend the book which is suited for old and young. It is perhaps specially adapted for presentation to intelligent boys. There are a number of illustrative woodcuts.

AUTOGRAPHIC PRINTING.

A method whereby drawings of objects under the microscope, of rare specimens of plants, insects, and other things, may be accurately, easily, and inexpensively multiplied has long been desired. Numerous attempts have been made to meet these requirements, but none with which I am acquainted seems to yield such satisfactory results as that lately perfected by Mr. A. Pumphrey, of Birmingham, which he calls the Autographic Printing process. This is a method, invented and patented by him, by which anything written or drawn with ink on paper can be multiplied to any extent, in absolute facsimile, and in any one colour. It differs from the Papyrograph and other devices of that kind in the fact that fine lines can be reproduced in all their perfection; another and very great advantage is that the original is in no way injured, as is the case in most other methods. A desire having been expressed by members of the Birmingham Natural History and Microscopical Society to see the process in actual work, the inventor attended at the Society's meeting, held on Tuesday, April 2nd, and gave an account of the process, and then proceeded to employ it in reproducing a number of various kinds of drawings. These sketches, prepared beforehand by members, having been given to Mr. Pumphrey, a prepared slab of slate, coated with a special preparation of gelatine, (which can be kept ready for use for an indefinite length of time,) was moistened with a solution of bichromate of potash, the drawing to be copied was placed in contact with the surface for a few seconds, and the ink on the paper, where it touched the gelatine, affected it and made it horny. Without any further operation, an ordinary inking roller was passed over the gelatine, the ink adhering to the slab only where the writing had touched. Clean paper was then laid upon it, and a little pressure produced a perfect copy. After one print was taken, the slab was moistened with clean water, and the operation repeated. With this number of the Magazine will be found a number of plates thus obtained, which reproduce the original drawings with excellent effect.*

It was at first supposed that any ink and paper would suffice, but the materials of which these are made are so various that it is advisable to use only those kinds which have been found to be most satisfactory. The chief requisite of the ink is that it should contain an excess of iron. Ink and paper of the best kind can be obtained from the patentee, Emily Street, Birmingham, and from Mr. T. Bolton, at his Microscopist's and Naturalists' Studio, 17, Ann Street, Birmingham, both of whom supply, at a small charge, a book giving full details how to obtain the best results, and a compact and handy apparatus, by means of which the printing can be done, as has been practically proved, by anyone. The price of this, with every requisite for producing prints similar to those

* We give with this number eight plates, produced by Mr. Pumphrey's Autographic process. Plate A illustrates Mr. Grove's communication, at page 52 (February) of the "Midland Naturalist," on "A Hybrid Fern." Plates B, C, D, E, and F are reproductions of some of the drawings above referred to by members of the Birmingham Natural History and Microscopical Society; Plates G and H are printed from drawings reproduced by Mr. Pumphrey at the *Soirée* of the Stroud Natural History and Philosophical Society, on the 9th of April. The process can be seen in operation at Mr. Bolton's Studio, 17, Ann Street, Birmingham.—EDS. M. N.

Plate B..

Produced by A Pumphrey's Patent Autographic Process.

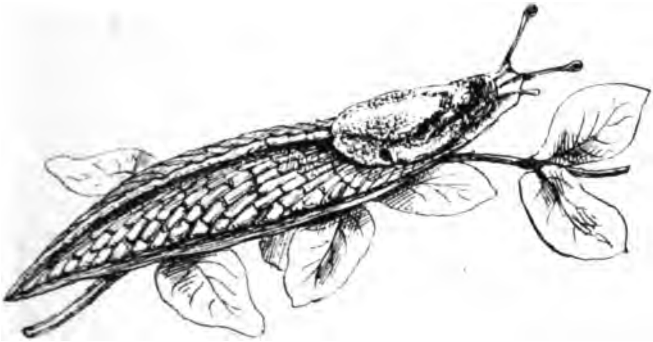


Fig 1.

Fig 2.

Fig 1 Limax carinatus

Fig 2 Helix pomatia

Plate C.

Produced by A. Humphrey's Patent Autographic Process.

Fig 1

Fig 2

Fig 1. Ptilota plumosa

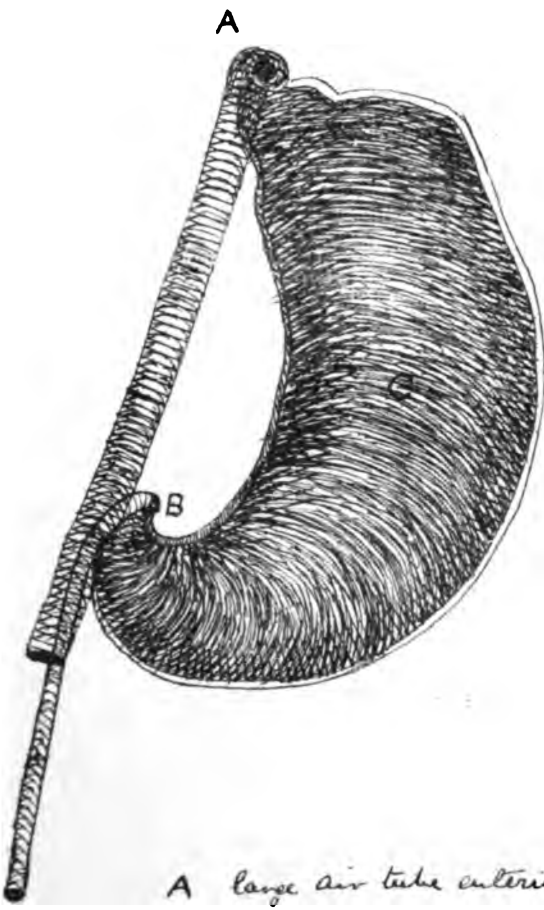
Fig 2 Aphis

Plate D.

Produced by A Humphrey's Patent Autographic Process.

Corethra Plumicornis Larval state.

Right Posterior air Sac



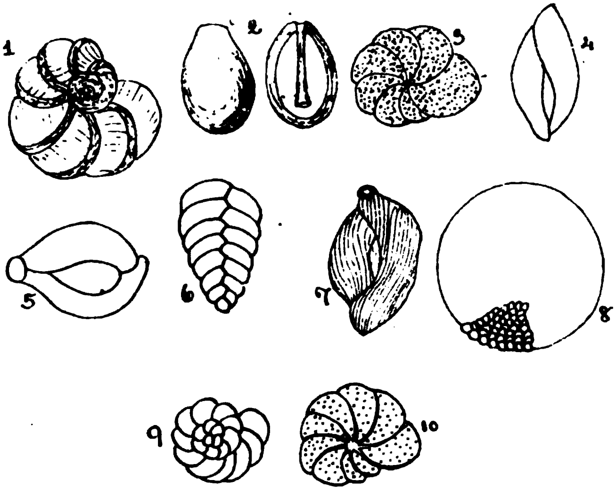
A large air tube entering air sac

B smaller air tube entering sac

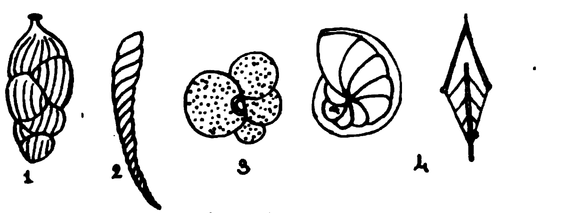
C air Sac

Plate E.

Produced by A. Pumphrey's Patent Autographic Process.



All the above genera of foraminifera were found in one slide from the Mediterranean
1 Peneroplis. 2. Entoselinia, whole and in section to show introverted tube. 3 Truncatulina
4 Polymorphina. 5 Miliolina. 6 Textularia
7. Adelosina 8 Fragment of Sorites. 9 Rotalina
10. Nonionina.

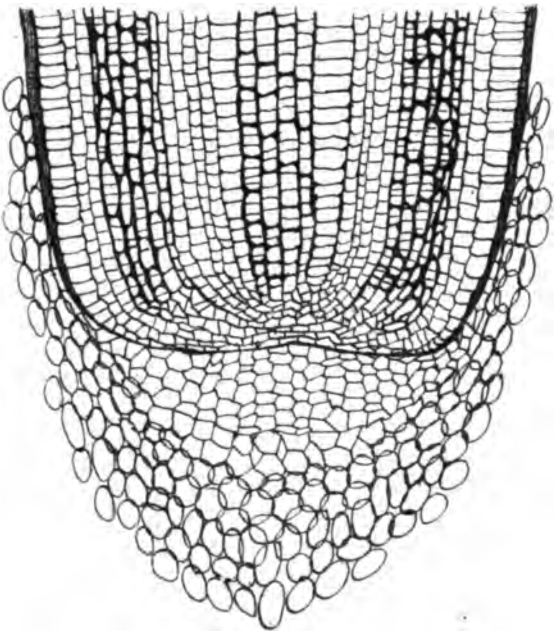


Foramenifera from the coast of Australia.
1 Uvigerina 2. Vaginulina. 3 Globigerina
4 Robulina seen sideways & edge-ways.

H.B. Forrest. Del.

Plate I.

Produced by A. Pumphrey's Patent Autographic Process.



Longitudinal section through the apex of a root of maize, (Zea mais.)

(After Sachs)

Plate G.

Produced by A. Pumphrey's Patent Autographic Process.

Produced before the Stroud Natural History Society from a sketch by a local delineator.

Plate II.

Produced by A. Pumphrey's Patent Autographic Process.

Produced before the Stroud Natural History Society from a sketch by a local delineator.

contained in the present number, is £3 12s., or without the rolling press, for which an ordinary copying press may be substituted, £2 2s. The gelatine plates, when used, will be exchanged for new ones by the patentee, at a very low price. Each plate will yield from 150 to 200 perfect copies, according to the style of drawing. When larger numbers are required, the best plan is to take an impression, while the plate is at its best, with transfer ink on transfer paper; if this be sent to a lithographer, more than 5,000 prints can be obtained from each of such impressions, thus multiplying, almost indefinitely, the number of exact facsimiles which can be produced. There is a great advantage in being able to transfer to stone, as any number of sketches can be combined together, or with letter-press printing. The latter is effected by taking an impression from the type with transfer ink, which can then be placed upon the stone with the drawing.

The autographic process is superior to lithography in the delicacy of its results. The only care required in making drawings for this purpose is to keep the lines as fine as possible, and to use only open shading. It is especially applicable to cases where only a limited number of copies is required, as for circulars, examination papers, music, &c., which can be printed at home, but, above all, for securing a record of any original microscopical or other observation; the drawing can be made without any elaborate preparation, and the absolute fidelity of the copies ensured.

W. B. G.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF MARCH, 1878.

BY W. J. HARRISON, F.G.S.

Want of space compels the compression of the monthly meteorological article, so that, instead of printing the *remarks* from each station in full, we must be content with a general summary. Notwithstanding this, we trust that every observer will continue to favour us with as many details as possible, especially of any remarkable occurrences, and of those facts in relation to animal and vegetable life which impart to meteorology much meaning and interest. We have quoted the references by our observers to the now famous "Eurydice squall" of the 24th of March in a special note.

March opened with charming and genial weather, "Coming in like a lamb," but it left us with a very ill grace, "Going out like a lion," thus literally reversing the old proverb. Temperature rose to 61° at Sedgley, on the 7th; and to 60° at Belvoir Castle (7th,) Worksop (1st,) and Dudley (1st.) The nights were very cold from the 22nd to the end of the month, the Cheltenham return of 12·2° (and on the grass 8·5°) on the night of the 25th, being very remarkable. Rainfall was decidedly below the average, and in most places the heavy land was so hard and dry that sowing was rendered impossible. Frequent falls of snow were experienced in the last week, those of the 27th and 28th covering the ground to a depth of 4in. or 5in. At Much Wenlock buttercups were in blossom on the 3rd, and the Wood Anemone on the 6th; Coltsfoot, Daffodil, and Palm, near Hereford, on the 7th. The Chiffchaff was heard at Kibworth on the 21st, and the small Bat seen flying near Stroud on the evening of the 3rd. The remarkable squall of the 24th is noticed separately.

STATION.	OBSERVER.	RAINFALL. Total for M. In.	Greatest fall in 24 hours. In.	Date.	No. of rainy d.	TEMPERATURE. Greatest ht. Deg	Date	Great'st cold Deg	Date.
GLOUCESTERSHIRE.									
Cainscross, Stroud	W. B. Baker, Esq.	1·86	·75	2	9	56.0	1	22·0	26
Cheltenham	R. Tyrer, Esq.	0·90	·24	1,24,& 31	7	56·3	7	12·2	25
Stroud	S. J. Coley, Esq.	1·56	·59	1	8	58·0	1	23·0	22
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	1·12	·24	28	13	56·0	1	24·0	23 & 24
Whitchurch	A. B. George, Esq.	1·48	·50	24	11	58·0	8	31·0	26
Woolstaston	Rev. E. D. Carr	1·25	·17	1	15	56·0	1 & 3	23·0	25
Leaton Vicarage, Shrewsbury	Rev. E. V. Pigott	0·94	·18	28	14	56·8	1	23·7	24
More Rectory, Bishop's Castle	Rev. A. Male	1·35	s.·26	24	17	52·0	1 2 18 19	22·0	24
Larden Hall, Much Wenlock	Miss F. R. Boughton	1·15	·25	24	13				
Bishop's Castle	E. Griffiths, Esq.	1·66	·35	24	15	53·0	7	25·0	30
Cardington	Rev. Wm. Elliot	0·91	·21	24	10				
Adderley Rectory	Rev. A. Corbet	0·70	·23	11	12				
Stokesay	Rev. J. D. La Touche	0·74	·25	28	10	57·6	7	24·9	14 & 15
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	1·17	·40	28	10			12·0	25
Stoke Bliss	Rev. G. E. Alexander	0·88	·39	28	8	58·0	1 & 3	26·0	24 & 31
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq	1·13	·38	28	14	59·0	1	25·5	23
West Malvern	A. H. Hartland, Esq.	0 54	·20	24	8	63·0	1	24·0	22 & 24
Pedmore	E. B. Marten, Esq.	0·95	s.·17	31	14	56 0	1 & 7	26·0	22 & 31
Stourbridge	Mr. J. Jeffries	0·86	s.·24	28	10	60 0	1	20·0	22 25 31
St. John's, Worcester	G. B. Wetherall, Esq.	0·69	·15	28	10	60·0	21	27·0	24
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	0.90	·20	28	12				
Barlaston	W. Scott, Esq.	0·97	0·32	11	8	56·0	8	17·8	23
Amblecote	Mr. J. Robins	0.87	s.·25	28	12			21·0	13 & 14
Dudley	Mr. J. Fisher	0·76	·15	11	9	60·0	1	22·0	23
Sedgley	Mr. C. Beale	0·98	s.·61	28	11	61·0	7	27·0	22 23 24
Kinver	Mr. T. Bolton	0·93	s.·18	28	13			16·0	26(25&31
Walsall	Mr. W. E. Best	0·90	s.·26	28	12	55·0	2	27·0	22 & 29
Grammar School, Burton	C. U. Tripp, Esq.	0·88	·24	10	9	58·0	3	24·0	24 & 26
Patshull Gardens	T. W. Dell, Esq.	1·04	s.·23	29	4	59·0	4 & 8	18·0	26
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	0·85	·18	28	15	57·0	1 & 7	19·0	23
Wrottesley	E. Simpson, Esq.	0·70	·21	28	10	56·5	2	22·9	23
Tamworth	W. Arnold, Esq.	0·99	s.·42	28	9				
Alstonfield Vicarage	Rev. W. H. Purchas	1·49	·48	1	11	53·8	4	19·3	26
Tean Vicarage, near Cheadle	Rev. G. T. Ryves	0·95	·20	1 & 21	15	56·0	1	21·0	26
The Heath House, Cheadle	J. G. Philips, Esq	1·20			15	52·0	1, 4,& 19	22·0	26
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	1·10	·54	27	11	57·0	7 & 8	25·0	23
Coventry	J. Gulson, Esq.	1·10	·60	27	10			25·0	30
Bickenhill Vicarage	W. R. Capel, Esq.	1·16	·40	27	12	55·0	3	26·0	23 & 24
St. Mary's College, Oscott	Rev. S. J. Whitty	0·90	·22	27	12	56·9	3	25·0	23
Henley-in-Arden	T. H. G. Newton, Esq.	1·12	·30	28	9	57·0	1	24·0	23
Rugby School	Rev. T. N. Hutchinson	0.86	s.·25	27	11	57·4	3	24·0	23
DERBYSHIRE.									
Buxton	E. J. Sykes, Esq.	3.63	·82	1	14	57·1	24	26·0	28
Brampton S. Thomas	Rev. J. M. Mello	0·57	·20	1	7	59·0	1	24·0	26
Stoney Middleton	Rev. U. Smith	1 31	·35	1	11	55·0	1	15·0	23 25 &31
Fernslope, Belper	J. G. Jackson, Esq.	0·87	·34	1	11	57 0	1	25·0	26
Matlock Bath	R. Chadwick, Esq., jun.	1·35	·48	2	13	58·0	19	23·0	23
Linacre Reservoir, Ches'field	C. E. Jones, Esq.	0·70	·16	2	12				
Willesly Gardens, Cromford	J. Tissington, Esq.	1·51	·42	1	9				
Stuffynwood Hall	Mr. R. Rolfe	0·57	s.·15	26	12	58·0	3	22·0	31
NOTTINGHAMSHIRE.									
Hodsock Priory, Worksop	H. Mellish, Esq.	0·64	·12	9	10	60·0	1	22·7	25
Grove House, Mansfield	W. Tyrer, Esq.	0·49	·13	26	12	58·2	10	25·0	25
LEICESTERSHIRE.									
Ashby Magna	Rev. E. Willes	0·68	·16	27	12	57·0	20	25·0	25
Market Harborough	S. W. Cox, Esq.	0·55	·20	28	6	56·0	1	22·0	23 & 24
Kibworth	T. Macauley, Esq.	0·71	·18	11	11				
Foxton Locks	Union Canal Company	0·38	·13	28	7				
Town Museum, Leicester	W. J. Harrison, Esq.	0·69	s.·23	27	13	56·8	1	26·0	24
Belmont Villas, Leicester	H. Billson, Esq.	0·71	·24	27	12	57·8	1	25·0	24
Syston	J. Hames, jun., Esq.	0·76	·30	28	12	56·0	22	24·0	26
Waltham-le-Wold	E. Ball, Esq.	0·70	·13	11	10	54·0	8	23·0	25
Little Dalby Hall	G. Jones, Esq.	0·64	·10	11	10	57·0	3 18 & 21	20·0	23 & 24
Coston Rectory, Melton	Rev. A. M. Rendell	0·60	·12	11	11	56·2	1	19·9	24
Belvoir Castle	W. Ingram, Esq.	0·42	·11	1	9	60·0	7	23·0	23
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	0·66	s.·14	24	11				
Castle Ashby	R. G. Scriven, Esq.	0·55	·13	31	8				
Sedgebrooke	C. A. Markham, Esq.	0·51	·12	31	11	58·0	2	26·0	31
Kettering	J. Wallis, Esq.	0·80	s.·18	24	10	59·0	2	25·0	23 24 &26
Althorp	W. F. Jakeman, Esq.	0·54	s.·15	31	8	57·0	1	20·0	31
Northampton	H. Terry, Esq.	0·63	·16	1 & 24	8	58·0	1	24·0	31
RUTLANDSHIRE.									
Burley-on-the-Hill	W. Temple, Esq.	0·58	·24	27	5	56·0	4	20·0	20
Tickencote	W. Hayes, Esq.	0·55	·17	24	10			24·0	24
OXFORDSHIRE.									
Radcliffe Observatory	Mr. J. Lucas	0·78	·32	31	9	58.1	1	26·2	22
CUMBERLAND.									
Spital Cemetery, Carlisle	T. Bell, Esq.	1·21	·38	1	12	58·8	19	28·0	14
ISLE OF WIGHT.									
Ventnor Hospital	Hartley Sagar, Esq.	2·39	1·03	28	9	61·4	2	29·6	23
CORNWALL.									
Altarnun Vicarage	Rev. G. Tripp	5·07	1·10	1	14	57·0	4	22·0	14 & 17

THE "EURYDICE" SQUALL.—Sunday, March 24th, 1878, will long be remembered as the date of the capsizing of H.M.S. Eurydice, with loss of about 300 lives, at four p.m., off Dunnose, on the east side of the Isle of Wight. The violent but brief atmospheric disturbance which was the cause of this catastrophe appears to have advanced from the N.W., and reached the north of England about ten a.m. Taking a south-easterly course, snow began to fall at Leicester about 1 45, and was followed by a strong gusty wind, but in an hour all was over. The barometer here fell but little, from 29·599 at nine a.m., to 29·494 at 12 45, and 29·477 at nine p.m. The next morning showed a marked recovery—29·731. The following interesting notes will show that the squall was of a more severe character in the West Midlands. The situation of the Eurydice—but a short distance to the S.E. of high cliffs, behind which chalk downs rise to a height of 800 or 900 feet, will sufficiently explain the way in which the squall took the vessel by surprise. The squall advancing from the N. W., the vessel was screened from it until it burst down the steep slope of the land in full fury.

The following notes on the weather of March 24th, are from observers whose names will be found in the Meteorological Returns for March, in connection with their respective stations:—BRAMPTON S. THOMAS, (Chesterfield.)—Lightning, with snow. ORLETON.—A sudden dense storm of snow, covering the ground 1½ inches deep, with a violent wind. TEAN VICARAGE, (Cheadle.)—The snow squall which swept across England from N. to S., reached Tean about noon, and cleared off about 12 45. CHELTENHAM.—A terrific snow storm, of short duration, burst over here at 2 P.M. STROUD.—Thunder and lightning, with violent wind, accompanying a snow storm. LEATON VICARAGE, (Shrewsbury.)—Violent storm at noon; darkness and heavy snow. MORE RECTORY, (Bishop's Castle.)—The snow storm or cyclone was very violent here about noon, and was followed by a display of Aurora Borealis at night. CASTLE STREET, (Bishop's Castle.)—The squall struck here with one terrific gust at 12 noon. STOKESAY.—A severe snow storm with strong N.W. wind at 12 noon; lasted about an hour. Bar. 29·531 at 12½; Temp. 35·5. WORCESTER.—The storm burst on us very suddenly from the N.W. at 12 40. The barometer only fell two-tenths of an inch from 9 a.m., and quickly recovered. TAMWORTH.—The storm struck here about 1 p.m., and the contrast in less than two minutes from bright sunshine to a perfect hurricane of wind, dust, and snow so thick and dense that nothing could be seen twenty yards off, was most extraordinary. It was all over and bright sunshine in about ten minutes. Bar. at 9 a.m. 29·84, at 1 p.m., 29·44. STONEY MIDDLETON.—Snowstorm 12 to 12 30, then clear till 6 p.m. COSTON.—Rapid fall of Bar. Snow from 1 30 to 6 30 with squalls of wind.

Correspondence.

LEPIDOPTERA.—On April the 18th, on the banks of the Great Western Railway between Reading and Oxford I saw three specimens of *C. Edusa;* also, one of *G. Rhamni.*—E. H. MAYCOCK.

THE HAREBELL WITH WHITE FLOWERS.—In 1875 I observed a number of white harebells on a bank in the parish of Dalby, on the chalk hills or wolds in the east of Lincolnshire. If I am in the same locality this summer I will look for them, and can then answer the two last questions. —A. E. J.

Petasites vulgaris, &c.—Can any of your readers explain why *Petasites vulgaris* and other wild flowers, which blossomed during January and February, near Oswestry, Birmingham, and elsewhere, should not blossom until a month later in this neighbourhood, so much farther south.—Observer, Stroud.

Rats.—A rat being closely pursued by a cat, jumped from a garden wall into the road and saved itself by jumping between the spokes of one of the wheels of a cart that at the time was passing at a good speed. The cat being baulked for a moment till the cart passed gave the rat time to escape. This was told me by a man living near Nottingham, who saw the circumstance.—C.

Pheasant and Pike.—I heard the following anecdote told by an experienced fisherman, who pronounced it authentic. A party of gentlemen were shooting over an estate, near Nottingham, close to the River Trent. A pheasant was wounded and fell in the river. A pike, which must have been on the look out for some sort of prey, immediately struck it, its teeth becoming so entangled in the feathers that it was easily captured, with the pheasant held fast in its teeth.—C., Nottingham.

Mosses.—It may be interesting to those readers of the "Midland Naturalist" who study the mosses to know that I have recently found near Kingswood, Warwickshire, a moss new to the county, *Orthotrichum leiocarpum*, Br. and Sch. In this station it occurs on the lower part of the trunks of the Ontario poplar. In other parts of Great Britain this moss is somewhat plentiful, but in Warwickshire it is apparently very rare. I may also state that I have also found, in abundance, *Sphagnum auriculatum*, a very rare sphagnum, near Solihull; hitherto I have only seen it in Sutton Park. In this new Warwickshire station it occurs on the borders of drains in a small wood, in company with *S. contortum*.—J. E. Bagnall.

Early Swallows.—Passing over Baginton Bridge on Sunday, April 7th, I saw about half a dozen swallows flying about over the water and adjoining meadows. I watched them for a few minutes, but in the course of a short time they disappeared. I recrossed the bridge later in the day, but none were to be seen, and I have not seen one since. The swallow usually returns to us about the 20th April, sometimes one or two are seen earlier, but I never before saw so large a party at this early period. On the same day I heard the Chiffchaff and the Wryneck. The former is generally the earliest arrival of our summer birds, and is later than usual this season.—John Gulson, Coventry, 10th April, 1878.

Prunella Vulgaris, White Variety.—I do not know whether this very pretty variety of the common *Self-heal* is anywhere abundant. It is but slightly mentioned by Syme, Hooker, or Babington. In this neighbourhood it occurs in one locality only, an old pasture field on the slope of a low ridge of boulder clay. But the large creamy-white flowers, closely aggregated in short, blunt heads, and of which six or eight in a head are often open at the same time, are much more elegant and showy than the purple ones of the common form. I think it deserves to be introduced into gardens, and I mean to try what cultivation will do for it. The leaves are all narrower than those of the common form; the lower leaves oblong-lanceolate and toothed at the base, the upper ones narrow and linear, some pinnatifid with linear segments, others merely toothed, the teeth projecting at right angles from the blade. I should be glad to hear of any other localities in which the white variety occurs, and whether it corresponds with the above description.—F. T. Mott, Birstal Hill, Leicester.

Preserving Fish.—I would in answer to T.'s enquiry (page 80) as to the best methods of preserving fish refer him for full directions to Mr. Montagu Brown's useful manual entitled "Practical Taxidermy," (Bazaar Office, London.)—F.

Cocks and Chickens.—We have had two instances at Highfield House of cocks taking to chickens. In 1837 a Dorking hen died leaving some young chickens, which a Dorking cock took charge of, brooding them like a hen, and rearing the whole number. Last year, (1877,) a Duck-wing Bantam cock sat on a single egg, hatched a chicken, brooded it as a hen, and altered his voice to the peculiar tone of a hen with chickens, exhibiting as much care of the chicken as would have been the case with a hen, and attacking in a savage manner anything that came too near the little one.—E. J. Lowe.

Preservation of Fungi for the Herbarium.—In reply to C. T. M.'s request (p. 79, ante) that some of your readers would describe the best method of preserving Fungi, I would refer him to the following sources of information, in either of which he will find all he can possibly require. The authors are practical Mycologists of the highest standing, and nothing can be added to the admirable instructions they give on this subject:—"The Outlines of British Fungology," by the Rev. M. J. Berkeley, a work indispensable to the student of fungi on account of the admirable plates, contains a chapter on the subject; as does also that excellent little work, "Cooke and Berkeley's Fungi: Their Nature, Influences, and Use." Mr. Worthington G. Smith contributed several chapters to "Hardwick's Science Gossip" for 1872, which are evidently the result of his own large experience. If C. T. M. will allow me I would strongly recommend to him what I have found of great value in my own case, namely, to make careful drawings of each species he collects to accompany the dried specimen. So many of the characteristic features of the larger *Hymenomycetes* pass away in drying that it requires considerable experience to make out a species from herbarium specimens, unaided by drawings, and hence the very general adoption of the practice I recommend among Fungologists.—William Phillips, Shrewsbury.

Deformed Primroses and Double Flowers.—The banks of the roads and lanes in South Devon are in many places for long distances covered with primroses. They often vary in colour, from the ordinary yellow to pure white, both on the sunny and shaded banks. Several of the white varieties were collected last spring, and planted in a garden in good rich soil. This year they have all bloomed freely and the blossoms were of the same pure white colour. In an orchard of the same district, where there were a great number of primroses in blossom beneath the trees, the blossoms of two plants looked like double flowers and one plant had the appearance of a polyanthus with primrose blossoms. The plants were removed and planted in the garden last spring. They all present the same peculiar aspect. Some perfect flowers have appeared, and upon the same plant flowers with the calyces containing five petals, two united by the stalk of the petal, and the three others are separate, (on one stem.) The same polyanthus-looking blossoms are coming out, and on one of the plants are pure double blossoms. Red-coloured primroses are common on the banks of the Teign. It has not fallen to my lot to notice such variety in the colour of primroses, in either Breconshire, Monmouthshire, Herefordshire, or Gloucestershire; and in no instance has a double primrose or one so deformed as above described been seen by me in a wild state before, and far removed from garden grounds. It is very common to meet with double-flowered cuckoo plants in Devonshire, and double-blossomed dwarfed brambles are common, especially in the Forest of Dean, Gloucestershire.—Henry Bird, Stroud.

Is the Arum an Insectivorous Plant?—This enquiry is made at page 106, where the fact is recorded that in numerous specimens of *Arum maculatum* examined last summer by the writer of the question small insects and chitinous fragments of others were invariably found inside the nearly closed spathes. The following observations may, perhaps, throw some light on the subject. For two years past I have grown a plant of *Arum crinitum* in my garden, and each year it has produced one of its lugubrious looking spathes. The plant grows about 18in. high. The spathe is very large, the spadix long and strange looking. The inside of the spathe and the whole of the visible part of the spadix are covered thickly with black hairs. When the infloresence is fully developed a most offensive carrion-like smell is emitted. Directly the disagreeable odour is produced blue bottle flies *(Musca vomitoria)* make their appearance and swarm on to the protruding lip of the spathe. Both years I have noticed no sign of these flies until the fetid smell of the Arum attracted them. Readers of Robert Browning's weird poem of the Pied Piper of Hamelin will remember how mysteriously the children were compelled to follow the insulted musician: the flies seem as strangely and powerfully fascinated by the Arum. They arrive in a bustle, they have evidently come purposely, they fly unerringly to the plant, they then speedily make their way to the narrow entrance to the lower part of the spathe in which the base of the spadix is chambered in almost absolute darkness. The inlet is narrow, and is well protected by the hairs before mentioned, though they seem no obstacle to the ingress of the flies. But after they are once inside there they must remain; whether stupefied by the noxious exhalation of the plant or imprisoned by the hairs which yielded them such easy entrance I do not know. I have watched the plant for hours, but never saw a fly return from what may be deemed a condemned cell. The spathe remains open only a day or two at most, and then gradually closes and shrivels up. Each year at an interval of a week or so after the closing of the spathe I have cut open the chambered part of it, and have found it nearly full of dead and partially decomposed flies. If I am fortunate enough to have the plant in flower this summer I shall take care to observe it more closely, and will forward it to Mr. Lawson Tait for examination.—E. W. B., Moseley.

Wasted Energy.—There are many hard-working Naturalists in the Yorkshire Union, and no doubt in the Midland too, whose energies are more or less wasted. Speaking of Entomologists particularly, too many devote all their attention to one family. Thus Lepidoptera are generally the insects most systematically collected, and there are instances of all the Entomologists in a society collecting nothing else. The result is a waste of energy, as half the number would generally work a district efficiently; whereas the larger number overdo it, and frequently exterminate the rarer insects. Where so many are engaged in the same pursuit there is sure to be rivalry as to who shall make the *largest* collection. Thus it comes to pass that a dozen or more specimens are obtained where two would serve every legitimate purpose. One male and one female with varieties are enough imagos for any scientific collection. To these should be added specimens of their various stages of metamorphosis. Larva-preserving is now so generally well understood that nearly all Lepidopterists can preserve larvæ (most kinds at all events) as well as they can set insects. These should invariably be mounted on a twig or leaf of the plant on which they ordinarily feed. The pupa and its cocoon (especially in the case of the Bombycidæ) should, where possible, always form part of the collection. But there are other fields where the energies of the Entomologist may find ample and useful employment, and where at present the workers are far too few. Take, for instance, the *Diptera*: how little is done with them, and yet how much wants

doing! Their, at first sight, unattractive appearance in part, perhaps, accounts for their neglect; yet not a few of the species are extremely beautiful. The scarcity of reliable, but not too expensive, books of reference, is doubtless another reason; but this should not deter us from collecting these insects and observing their habits. When a sufficient demand exists for the books, they will probably be forthcoming from some quarter or other. The *Hemiptera*, again, is another despised group: but why? The insects are generally small, it is true, but science is not chiefly concerned about mere size, and as to colour this class includes some real beauties, I would therefore urge Entomologists to extend their operations to some of these too little known classes of insects. A little more mutual help is also much wanted among us. Thus, when a Lepidopterist is out collecting and meets with insects other than those he is specially interested in, he might often be of use to some fellow workers if he would devote a little trouble for their sake, and pick up "bugs," or bees, or other insects which he knows them to care for. In return he would invariably be helped in his pursuit. "Fellow feeling makes us wondrous kind." Speaking for myself, I shall always be glad to send *Lepidoptera* in exchange for *Diptera* or *Homoptera*, and shall only want to know concerning any specimens sent to me the locality from whence they are obtained.—S. L. Mosley, Hon. Sec., Huddersfield Naturalists' Society, Primrose Hill, Huddersfield.

A Parasitic Worm infesting the Air Sinuses of the Common Weasel.—April 13th, 1878, Mr. Montagu Browne, the Naturalist, forwarded to me, for the purpose of ascertaining the cause of death, an adult specimen of the common weasel, which had not been trapped or shot. I carefully examined all the abdominal and thoracic viscera, squeezing up their structures into thin layers for the purpose of finding any parasitic larvæ or adult worms. I searched the alimentary canal from the mouth to the anus but found no parasites. Not suspecting that the air sinuses and nostrils might contain parasites, I was stupidly content to let them pass with a cursory glance; but as I desired to observe the arrangement of the bones of the ear in this animal, I commenced to skin the head, and arriving at the point of union of the frontal bones, I observed a round hole in the median line, one-eighth inch in diameter, covered with a clear transparent membrane, which was continuous above and internally with the periosteum. I could not make out any mucous lining, though I suppose there should have been one, for the sinus communicated immediately with the left nostril. On removing this clear membrane, which looked as though it covered a hole filled with ink, I found what at first sight appeared to be small elongated clots of blood. There were no movements whatever, no apparent sign of life; however, I examined one of them, and made out that it was a worm, (a female,) full of eggs for about one half its length, and the remaining half occupied by many hundreds of minute, young, living, wriggling worms. There were in this sinus six specimens, four females, and two males. The male is considerably smaller than the female, not reaching to even half her size in the largest and best developed specimen. The female, the largest, measured one inch and a quarter long, and the thirty-second of an inch in diameter, and the smallest specimen, which contained both eggs and young alive, measured half an inch long and about four lines in greatest diameter. After being satisfied as to their character I proceeded cautiously to search the remaining sinuses, the brain and its cavities. The brain was healthy as far as the microscope could determine, but the sinuses were full of the parasite. In the sinus of the left temporal region no less than fourteen of these creatures were discovered coiled round one another and dead, twelve of them females and two males; in the air passages of the

nose, amongst the expansions of the olfactory nerve, I found eight other specimens, all of which were males. I then examined the auditory canals, but no traces of the parasite were to be seen. I immediately prepared some of them as specimens for the microscope, thinking that if I could keep the young alive *in situ* until the next meeting of the Birmingham Natural History and Microscopical Society, when Mr. W. R. Hughes, F.L.S., was to present a paper on an allied subject by Dr. T. Spencer Cobbold, I might, perhaps, assist in throwing light upon a matter of considerable difficulty, one which has occupied the minds of some of the most distinguished scientific observers for years past, and which is now bearing fruit in the shape of contributions of a character so important to the medical and non-medical world, that I feel bound to express my personal obligation to Dr. Cobbold for the very complete form in which he is bringing the subject before the Society and general science-loving public. The mounted specimens were exhibited at that meeting, immediately after Dr. Cobbold's paper. The young worms were then alive, as was testified by Mr. Hughes himself and several others, having then been mounted in Canada balsam for four days, showing the extreme vitality of these young minute threads of living matter. I have written to Dr. Cobbold, and sent him specimens for examination, and until I hear from him, with his declaration as to the name of species of this round worm, I must defer my anatomical description. It may turn out to be a well-known form. If it does, no description will be necessary; but any departure from the usual form will be noted and described. The worm, and the skull showing the sinuses, may be seen at Mr. Bolton's Studio, No. 17, Ann Street, Birmingham, where I have placed them for inspection.—WRIGHT WILSON, M.R.C.S., F.L.S., &c.

Gleanings.

OUR UNION.—We have much pleasure in announcing that at the annual meeting of the Woolhope Naturalists' Field Club at Hereford, on the 23rd April, it was unanimously resolved that the Club join the Midland Union of Natural History Societies.

PRACTICAL TAXIDERMY.—Under this title a valuable book by Mr. Montagu Browne, of Birmingham, has recently been published at "The Bazaar" Office, London. In an early number we hope to review it at length.

RUBI.—In the March number of the "Journal of Botany" Professor Babington commenced a series of articles "Notes on Rubi." In the March and April numbers are criticisms on little understood forms, which will be read with interest and instruction by all students of this difficult genus.

LICHENS.—In the "Quarterly Journal of Microscopical Science" for April a valuable contribution appears, entitled "Recent Researches into the Nature of Lichens," by Sydney H. Vines, Fellow and Lecturer of Christ's College, Cambridge, in which the more recent speculations for and against the Algoid Nature of Lichens are given, and very ably criticised.

BRITISH HEPATICÆ.—Students of these interesting plants will be glad to see by an announcement on cover of present month's number, that a fasciculus of seventy-five specimens, representing sixty species, illustrative of "Carrington's British Hepaticæ," will be ready for distribution on 1st June next. Communications should be addressed to Mr. W. H. Pearson, 115, Church Street, Pendleton, Manchester.

Bland's Lessons on Elementary Botany, reviewed in our last number, has, we learn, been revised, and new editions of Parts 1 and 2 are in the press, and will be ready in a few days.

A Cat Walking Seventy Miles.—The *Sheffield Daily Telegraph* says a family recently removed from Dawley, Shropshire, to Nottingham. They took with them a cat which they had had for years. A few days after arrival at Nottingham she disappeared. The other day the cat walked into the old house at Dawley, to the great surprise of the neighbours. She was very footsore and lame, but otherwise all right. The distance travelled by the cat is over seventy miles. It is strange how the cat traversed the whole distance without being lost or worried.

Birmingham Philosophical Society.—The first part of Vol. I. of the proceedings of this Society, (Session 1876-7,) has just been issued. Its contents are as under:—"New Researches in Contractility and Elasticity," by Professor R. Norris, M.D., F.R.S.E.; "Vortex Motion," by J. Hopkinson, D. Sc., M.A.; "The Kinetic Theory of Gases," by the Rev. H. W. Watson, M.A.; "The Study of Science as an Instrument of Higher Education," by G. Hookham, M.A.; "The Place of Archæology in Science," by James Kenward, F.S.A.; and "The Evolution of the Sense of Hearing," by Lawson Tait, F.R.C.S.

The Herefordshire Pomona, about to be published by the Woolhope Naturalists' Field Club, is being got on with vigorously. The letterpress of Part I. is quite ready, and its publication will take place as soon as the coloured plates can be finished. Prepared as it is by such competent hands, the Herefordshire Pomona will no doubt be a work of considerable merit. The introductory matter of the first part consists of an elaborate treatise on "The Early History of the Apple and Pear," mythically, mythologically, and historically considered. This is followed by a sketch of "The Life of Thomas Andrew Knight and his Work in the Orchard." The common belief in the limited duration of varieties of apples is here stoutly called in question; and the results of Mr. Knight's experiments in the production of new sorts of apples and pears by hybridisation, is also fully entered into. In short, the introduction is the result of much work and much thought; and, what is of still more importance, contains matter in practical physiology that can scarcely fail to make others work and think too. Then will begin the main object of the Pomona—to give beautifully coloured plates of all the best varieties of apples and pears, &c. Communications from intending subscribers should be addressed to Mr. J. R. Symonds, Hereford.

Mr. Bolton's Microscopist's and Naturalist's Studio.—Mr. E. Ray Lankester, F.R.S., has contributed a note in the current number of the "Quarterly Journal of Microscopical Science," on the agency recently established by Mr. Bolton, at No. 17, Ann Street, Birmingham, for the supply of microscopic organisms to students and class teachers, from which we have much pleasure in copying the following extract:—"If serious students of our pond-fauna and flora will avail themselves of Mr. Bolton's services, and not only purchase from him examples of the specimens he has on hand, but will also *send to him supplies of such rarities as they may find, for the purpose of distribution among his correspondents and customers*, we shall have started among us an agency which will be of immense service not only to the individual student but also (and perhaps chiefly) to the teacher who requires to be able to obtain supplies of given microscopic organisms for his practical classes, and to feel with absolute certainty that the specimens needed will be forthcoming on the appointed day. Mr. Bolton can, at present, be depended on for certain forms; after a little time he will be able no doubt to enlarge his list."

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—March 26th, GEOLOGICAL SECTION.—Rev. H. W. Crosskey, (President of the section) delivered an address on "Some Problems in Glacial Geology." He described in detail a section near Glasgow in which the lowest bed was the typical till or boulder clay. This is succeeded by finely laminated clays, probably derived from the first during a slow sinking of the land, the continuance of which is proved by beds containing shells showing first littoral and then deep sea conditions. Afterwards a gradual rise took place, as shown by gradually altering species of shells, until in the upper portions of the section estuarine and freshwater species, prevail. The climate seems to have gradually ameliorated from the time of the land ice, though with some fluctuations. The same series of changes both in level and climate are traceable in Canada and South Norway. Mr. Crosskey believes that the climatic changes were due to the alterations in the distribution of the land surface, which interfered with the ocean currents and changed their directions. The address was illustrated by a beautiful and very numerous collection of fossils from the beds described.—Mr. Slatter, of Redditch, showed calamites and *Estheria minuta* from the waterstones near Redditch. April 2nd, GENERAL MEETING.—Mr. A. Pumphrey described and exhibited his new process of autographic printing.—Mr. Wright Wilson, F.L.S., exhibited the brain of a shrew mouse, *(Lorex vulgaris,)* showing apoplectic clot on the right hemisphere.—Mr. W. G. Blatch exhibited the angle-shades moth, *(Phlogophora meticulosa,)* from Knowle. This was found in March. It is generally found in June and later.—Mr. J. E. Bagnall exhibited a confervoid alga *(Draparnaldia plumosa)* and a moss *(Orthotrichum leiocarpum,)* both from Kingswood, the latter new to Warwickshire.—Mr. T. J. Slatter exhibited a confervoid alga belonging to the genus *Tyndaridia.* April 16th, MICROSCOPICAL GENERAL MEETING.—Mr. W. R. Hughes, F.L.S., read the third paper by Dr. Spencer Cobbold, F.R.S., on "The Parasites of Man."—Mr. Wright Wilson exhibited a nematode worm, found in the air sinuses of the skull of the ordinary weasel, *(Mustela vulgaris,)* apparently allied to *Oxyuris vermicularis*, which infests the human intestine.—Mr. T. J. Slatter exhibited *Testacella haliotoides*, a slug which feeds on earth worms, also the male of *Diaptomus castor.* Mr. T. Bolton exhibited one of the microscopic fungi *Æcidium Urticæ*, the golden cluster cup on the leaf of the nettle.

BURTON-UPON-TRENT NATURAL HISTORY AND ARCHÆOLOGICAL SOCIETY.—ANNUAL MEETING, March 26th.—The following officers were elected for the year 1878-9:—The Rev. C. F. Thornewill, M.A., President; Mr. H. G. Tomlinson and Mr. J. C. Grinling, Vice-Presidents; Mr. H. Partridge, Hon. Treasurer; Mr. C. U. Tripp, M.A., and Mr. T. C. Martin, Hon. Secretaries; Committee—Messrs. R. Anty, W. Boden, H. T. Ford, J. T. Harris, A. J. Lyle, P. B. Mason, C. Perks, R. Thornewill, W. C. Owen, and C. J. Crawshaw. The following prizes were awarded to the successful junior members:—Botany: Mr. J. E. Nowers, first prize; Mr. S. R. Hallam, second prize. Geology: Mr. A. Molyneux. Freshwater Life: Not awarded.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY, NATURAL SCIENCE SECTION.—Papers read before the Section during April: —April 3rd: Microscopical evening. Mrs. Cowen read a paper on "Raphides and Plant Crystals," which will be printed in the "Midland Naturalist" for June. April 17th: Mr. J. J. Harris Teall, M.A., F.G.S., read a paper on "The influence of the Earth-movements of different Geological Periods on the Physical Structure of the British Isles.

NOTTINGHAM NATURALISTS' SOCIETY.—March 20th: A paper on "A Dead Fly" was communicated by Mr. R. A. Billiald. April 3: A lecture on "Optical Illusions," illustrated by numerous experiments, was delivered by Mr. A. H. Simpson, President of the Society.

STROUD NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.—The Winter Session closed on 9th April, with a most successful conversazione. Mr. C. Playne was elected President for the ensuing year, and Mr. J. H. Taunton a Vice-President. The following re-elections were also made:—Mr.

Witchell, a Vice-President; Dr. Partridge, Secretary; Mr. Bishop, Treasurer; Mr. Smith, Librarian; and the whole of last year's committee. The Secretary read the Committee's Report, which gave a satisfactory account of useful work done by the Society, which is in a flourishing condition. The retiring President, Mr. J. E. Dorington, delivered an excellent address, in which he reviewed the proceedings transacted during his term of office. A vote of thanks was unanimously accorded to Mr. Dorington.—Dr. Bird then read a paper on "The Ancient Dwellers of the Cotswolds," an abstract of which we hope to present to our readers. The exhibition of scientific apparatus and objects, which next occupied the attention of the meeting, was varied and interesting. Mr. A. Pumphrey and Mr. T. Bolton, of Birmingham, exhibited and described the autographic printing process dealt with fully in another page. Mr. Bolton also exhibited numerous interesting specimens of freshwater life. The electric pen, the process of electro-plating, a telephone, spectroscopes, collections of entomological and geological specimens, and other matters, fully occupied the remainder of the evening.

TAMWORTH NATURAL HISTORY, GEOLOGICAL, AND ANTIQUARIAN SOCIETY.—March 25th.—A handsome and well-preserved skin of an Egyptian crocodile was presented to the society, through the secretary, by Mr. Charles Long.—Dr. Joy read a paper, entitled "The Darwinian Theory Reviewed." A warm discussion followed the reading of the paper, in which the Chairman, (Rev. Brooke Lambert,) Dr. B. W. Foster, of Birminhgam, Messrs. Chesshire, Nevill, Hamel, and others took part. April 1st.—Mr. R. B. L. Johnston gave a paper on "Sponges, Hydras, and Corals." After describing the several varieties of sponge, and the numerous members of the Hydra family, he proceeded to touch more fully on the many species of coral. He exhibited several beautiful specimens lent by members of the society.—A small skate, dried and mounted, was presented by the Rev. Brooke Lambert.—Mr. W. G. Davy exhibited a cryophorus, the water within which was by evaporation frozen in a few moments.

YORKSHIRE GEOLOGICAL AND POLYTECHNIC SOCIETY.—The first meeting of this old Society since it changed its name was held on the 13th March, at Selby. The attendance was large. The local secretary, Mr. J. T. Atkinson F.G.S., who presided, gave an interesting address, in which there were references to local history, a *resumé* of the history of the Society founded forty-one years ago, and an account of the geology of the district. Mr. Atkinson entertained the members at luncheon. Later in the day a second meeting was held, the Chairman of which was Mr. H. C. Sorby, F.R.S., President of the Geological Society. Twenty-three new members were proposed, and a resolution passed that the June meeting should be held at Scarborough, or Bridlington if suitable arrangements could be made; or failing both, at York. In addition to a paper by Mr. J. E. Clarke, B.A., B.Sc., F.G.S., on "The Triassic Gravel, Sand, and Clay Beds at Sutton Park, near Birmingham," the Chairman contributed an important one on "A New Method of Studying the Optical Character of Minerals."

WEST LONDON ENTOMOLOGICAL SOCIETY.—March 22nd.—Mr. Reed exhibited a series of *B Hirtaria*; bred. March 29th.—Mr. Walford, bred specimens of *Verbasci*. April 12th.—Mr. Maycock, *Pilosaria* and *D. Fagella*; also a series of *Leucophearia*, varying from the ordinary type to black. Mr. Coverdale, *Lithoriza* and *Parthenias*. Mr. Gates, *Multis-trigaria*. Mr. Meek, a very fine series of varieties of *L. Monacha*, some of the specimens being quite black.

EXCHANGE.

I have vols. 1 to 5 of The Geologist, (1858 to 62;) Geological Record for 1875; Smithsonian Reports; Geological Society's Journal, 1876 and 1877, &c. I want set of Geological Magazine; Science Gossip; Report Coal Commission, 1871; vols. 1 to 14 Geological Society's Journal; or will give fair cash price.—F.G.S., *Herald Office*, Birmingham.

Bird eggs, side blown, 200 species, rare duplicates. Exchange lists supplied. Wanted various varieties new to collection. All letters answered.—J. W. Sissens, Sharrow, Sheffield.

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

FIRST ANNUAL MEETING, AT BIRMINGHAM,

ON MONDAY AND TUESDAY, MAY 27TH AND 28TH, 1878.

The arrangements for the forthcoming Meeting of the Members of the Societies in the Union are so far made that we are enabled to publish the following particulars:—

On Monday, May 27th, the Annual Meeting of the Union will be held in the Theatre of the Midland Institute, Paradise Street, Birmingham, at three o'clock precisely, under the presidency of Mr. Edmund Tonks, B.C.L., President of the Birmingham Natural History and Microscopical Society. The business of that Meeting will be to receive the Report of the Council; to decide where the Annual Meeting in 1879 shall be held; to consider any suggestions which Members may offer; to discuss Joint Excursions during the coming year; and to transact all other necessary business.

In the evening, at half-past seven o'clock, a Conversazione will be held in the Town Hall, the arrangements for which are entrusted to a Committee, consisting of Members of the following Societies, namely:—

The Birmingham Natural History and Microscopical Society,
The Birmingham Philosophical Society,
The Birmingham and Midland Institute Scientific Society, and
The Birmingham School Natural History Society.

Every effort will be made to provide an Exhibition of objects of Scientific interest, Natural History, Archæology, and Art, worthy of the Union and the town in which its First Annual Meeting will be held. Members of Societies in the Union willing to contribute Specimens or to exhibit or lend Microscopes will oblige by at once communicating to Mr. John Morley, 24, Sherborne Road, Birmingham, Hon. Sec. to the Conversazione Sub-Committee. The charge for admission to the Conversazione (including Refreshments) will be 2s. 6d. Morning Dress.

On the following day, Tuesday, May 28th, there will be an Excursion to Dudley and the neighbourhood, under the auspices of the Dudley and Midland Geological and Scientific Society and Field Club, which it is hoped will include visits to

I.—Open Coal Work at Foxyards.
II.—Wren's Nest.
III.—The Priory Ruins and Castle, and also to the Caverns, if considered safe.
IV.—Lye Cross Pits.

All by special permission of Mr. E. Fisher Smith, on behalf of the Right Hon. the Earl of Dudley.

Arrangements will be made to meet the wishes of Visitors who may desire to inspect some of the leading Birmingham manufactories.

As the success of the Conversazione and Excursion will very much depend on ample arrangements being made for the accommodation of Visitors from a distance, and as it will be impossible to make those arrangements without knowing the number who will be present, the Secretaries of the Societies in the Union are earnestly urged to bring these particulars before their Members at the earliest possible moment, and to ascertain what number will require tickets, which should be applied for as soon as practicable, *but under no circumstances later than* TUESDAY, *the 21st day of May*. Applications for tickets must be addressed to Mr. Edw. W. Badger, *Midland Counties Herald Office*, Birmingham.

Members may secure Tickets for friends not Members of the Union.

At the earliest possible moment the detailed Programme will be issued to the Secretaries of all the Societies in the Union, for distribution among the Members. If special Railway facilities for Members and Friends coming from a distance can be secured full information will be given in the detailed Programme.

Plate II.

Fig 7 x 100.

Fig 11 x 200

Fig 9 x 120

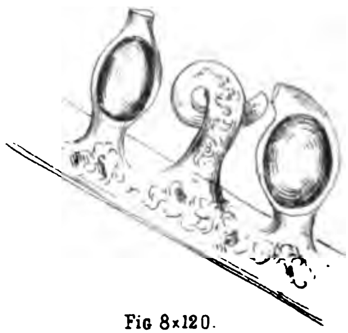


Fig 8 x 120.

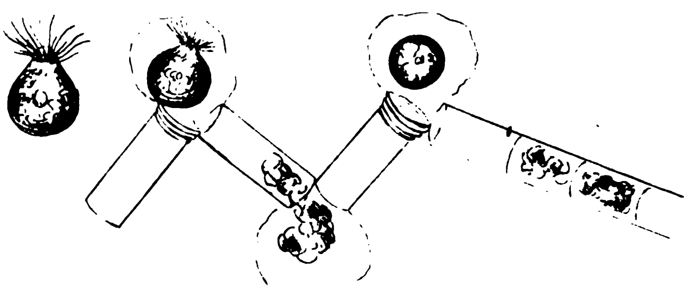


Fig 10 x 160.

A.W. WILLS. del et lith.

FRESHWATER ALGÆ.*

BY A. W. WILLS, F.C.S.

(*Continued from page 117.*)

We must now turn to the very important question of the modes of multiplication and reproduction of these singular plants.

In the simplest forms of unicellular Algæ, (*Palmellaceæ* and *Volvocineæ*,) the only mode by which most of the genera seem to be perpetuated consists of the conversion or breaking up of the contents of certain cells into small oval bodies, (zoospores,) which move freely through the water for a while by means of delicate lashes or cilia, and then, after losing these motile organs, undergo cell-division into fresh individuals, identical with the parents. [Plate I., Fig. 2.]

In *Desmidiaceæ*, to this process is superadded that of reproduction by the formation of large "resting-spores" resulting from the commingling of the contents of two separate individuals in the space between their adjacent sides. [Plate II., Fig. 7.] Such spores are capable of retaining their vitality for a long period, and then producing from their contents a fresh generation of plants of their specific kind; while, on the other hand, zoospores undoubtedly perish, unless placed in conditions favourable to their immediate germination.

In many of the higher order of Algæ (freshwater and marine) both these phenomena can be traced, and it appears probable that in all cases the development of spores alone constitutes a true sexual reproduction of the species, comparable to that which prevails among Phanerogams, whereby its indefinite perpetuation is secured; while the so-called "reproduction" by zoospores is rather to be compared to the increase of flowering plants by buds or offsets, or artificially by cuttings, a process by which, as is believed by most florists, while the multiplication of individuals is accomplished, the continuation of the species is not secured beyond certain limits.

It is probable that even in those genera in which no such sexuality or *polarisation* of cell-contents has been observed, it has yet to be discovered, much as the fine researches of Messrs. Dallinger and Drysdale "On the Life History of Monads" have proved, that after the succession of many generations of asexual individuals among the lowest Infusoria, a sexual process suddenly intervenes.

The production of spores in *Desmidiaceæ* is a most interesting phenomenon, and will be best understood by those to whom it is

* DESCRIPTION OF FIGURES IN PLATE II.

Fig. 7.—Formation of resting-spore of *Micrasterias rotata*, from contents of two plants.
Fig. 8.—*Vaucheria ornithocephala*.
Fig. 9.—*Vaucheria racemosa*, showing "horns" and flask-shaped cells, the latter containing spores.
Fig. 10.—Formation of zoospores from contents of single cells in *Œdogonium*.
Fig. 11.—Formation of spores in *Œdogonium*, the contents of the enlarged cell being fertilised by spermatozoids developed in dwarf parasitic male, or antheridial plants.

not familiar by reference to our sketch. [Plate II., Fig. 7.]* Two individuals approach one another, and a communication being established between them through the bases of their separated halves, the cell-contents are poured out into the intervening space and there form a spore, generally spherical and at first smooth, but in the mature state often ornamented with tubercles or spines. In this condition the structure and markings of the empty cellulose cases are beautifully displayed.

What is the exact series of changes by which the original form is developed from the spore requires further investigation, in spite of Berkeley's statement that it is propagated in some species by division, exactly after the fashion of the ordinary cells, and in the third generation acquires its normal form.

Other points in the physiology of these plants also await further research, as, for instance, the nature of the curious circular hyaline spaces filled with moving granules, which are seen in the ends of the frustules of *Closterium* and *Penium;* the circulation of similar particles between the cell-walls and the endochrome; and the remarkable "swarming" of the entire cell-contents, which occurs in some genera, probably before conjugation, when every grain of endochrome seems to be rushing wildly in and out among its fellows in a sort of giddy dance.

Passing from the unicellular to the filamentous Algæ, which consist for the most part of elongated cylindrical cells placed in juxtaposition, end to end, in various arrangements, we are compelled by want of space only to glance at many large and interesting orders. Among these are the *Batrachospermeæ*, represented by the exquisitely graceful genus *Batrachospermum*, whose gelatinous tresses of tender grey or olive green whorled branchlets are not uncommon in clear streams in this district; the almost equally beautiful *Chætophoraceæ*, of which abundant examples are to be found in the deep green gelatinous masses of *Chætophora endiviæfolia* and *C. elegans*, in the tender green filaments of *Draparnaldia plumosa* waving gracefully in clear running waters, and in the singular disk-shaped fronds of *Coleochæte scutata*, found adherent to leaves of submerged aquatic plants; the *Oscillatoriaceæ*, which comprise many singular forms, inhabitants of pools, wet rocks, damp ground, &c., and well represented in our district; and finally the *Nostochaceæ*, of which the typical genus *Nostoc* contains many species, consisting of long beaded filaments, twisted like intricate coils of rope, and agglomerated into gelatinous fronds ranging in size from that of a pea to that of a walnut, most cosmopolitan in their habitats, rejoicing in situations so various as clear streams, exposed moorlands, and thatched roofs.

In what remains of this paper we purpose to refer in some detail to three of the remaining groups of Confervoid Algæ, each of which presents interesting points of structure and remarkable aspects of the phenomena of reproduction.

First among these is the large family of *Siphonaceæ*, of which the commonest examples are the various species of *Vaucheria*, some of which

* The figures given in these papers are all drawn under the microscope, from actual specimens. We do not hesitate to insert them, because those given in text books are often only diagrammatical, and convey but an imperfect idea of the actual object.

form a close felt-like coating at the bottom of almost every ditch. They consist of long, more or less branching filaments, not divided into a number of cells, but open from end to end and filled with very dark green endochrome. The cell contents are frequently poured forth from the ends of the filaments in the form of large ciliated zoospores, of which operation a good description will be found in Hassall's "Freshwater Algæ." But there is, in addition to this, a true process of sexual reproduction, as singular as it is interesting.

At various points on the filaments are formed two very distinct kinds of projections—the first consisting of one or more narrow "horns," as Unger appropriately terms them, forming short branches from the parent filament, sometimes straight and at others curiously curved; the second, in close proximity, assuming the form of one, two, or occasionally more, flask-shaped cells, open at their apex. [Plate II., Fig. 8.] In one species, *V. racemosa*, both kinds of organ are carried upon a common shaft or pedicel. [Plate II., Fig. 9.]

The contents of the flask cells gradually assume an irregular spherical shape, while those of the "horns" are converted into active *Spermatozoids*, which issue into the surrounding water, and thence swarm through the narrow neck of the flask-shaped spore-cells, and there fertilise their contents. These thereafter assume a true spherical form and a distinct cell-covering, while between them and the filaments which bear them dissepiments are formed, at which the heads finally break off, and by decay of their outer walls at length liberate the spores.

The singular plant *Hydrodictyon utriculatum*, remarkable for its growth in a network of hexagons, and for the marvellous rapidity of its increase, is referred to the same family *(Siphonaceæ.)* A good summary of its life-history is to be found in the Micrographic Dictionary, and a detailed investigation is recorded in the researches of A. Braun, (Ray Society, 1853.) Some years ago it suddenly appeared in Blackroot Pool, Sutton Park, in enormous quantity; in a few weeks it wholly disappeared, and we have never seen a trace of it since in that habitat.

The *Œdogoniaceæ* comprise two genera, *Bulbochæte* and *Œdogonium*; the former containing only one species, the elegant little *B. setigera*, a plant of great beauty by reason of the long slender bristle-shaped cells which form the ends of its lateral branches—a lovely object, especially by dark back-ground illumination.

It is said to be reproduced by zoospores, and also by a process very similar to that described above as occurring in *Vaucheria*, each resting-spore being ultimately resolved into four smaller ones, which develop into four new plants. We have not been fortunate enough to witness these phenomena, although we have frequently gathered the plant, both in our own district and elsewhere. The genus *Œdogonium* includes several common species, some characterised by a very curious annular structure at the base of many of the cylindrical cells of which the plant is made up, which becomes especially manifest when the filaments break up into separate joints for the emission of zoospores. [Plate II., Fig. 10.] We were once fortunate enough to see this curious process taking place under the microscope in a specimen which had been *just mounted*, and

think that a brief description of one of the most remarkable sights we have ever been privileged to witness, taken from notes made at the moment, and illustrated by sketches made from the specimen in question, will prove more than usually interesting.

"At 12 20 this afternoon, on placing the slide under the microscope, I observed that one of the long filaments was breaking up rapidly into a zig-zag of separate joints, each of which remained attached only at a single point to its neighbour. Placing one cell in the middle of the field, I watched it closely, and observed that the somewhat oval mass of endochrome was gradually leaving the cell-case, though clinging to its base as if reluctant to leave it. At the same time there appeared a very faint transparent membrane across the mouth of the open cell, *exactly like a thin soap bubble being blown out of it.* This quickly increased in size *pari passu* with the extrusion of the endochrome. At 12 25 this had completely left the cell and formed a spherical green mass inside the "bubble," in fact an incipient zoospore. This now began to move very slightly, and at one side of it appeared faint traces of cilia waving a very little, suggestive of a piece of machinery just getting started. At 12 30 the "bubble" was much blown out, and the cilia active, the zoospore twirling round for part of a revolution and then stopping, and so on. At 12 35 the membrane was more enlarged, and only faintly discernible by very careful illumination. At 12 40 the zoospore was liberated; the ciliated end slightly protruded and transparent; its motion regular and swift. At 12 47 this motion was much diminished, the zoospore slowly creeping round with an irregular motion from left to right. At 12 50 the ciliary action had become sluggish, and the endochrome was receding from the cell-wall. The vibration of the cilia gradually diminished till 1 1, when it quite *suddenly* ceased altogether; at the same moment the whole mass of endochrome was *violently convulsed with a sort of shuddering movement*, and the transparent point was much protruded. By 1 3 the cilia had disappeared, the projection of the point was largely increased, and there is no doubt that if the germination had not been arrested by enclosure in the glass cell, the next stage would have been the formation of a distinct nucleus, and the separation through this into two cells, in fact the first process in the development of a filament like the parent one."

How enormous is the rate of increase in this plant may be inferred from the fact that in one filament in this specimen, both ends of which were broken, the number of cells still remaining was 683.

It will be seen from Plate II., Fig. 10, that each zoospore is the product of the endochrome of one cell only.

The formation of true spores in *Œdogonium* is the result of the fertilisation of the contents of certain cells by the entrance through small slits in their margins of spermatozoids; these being produced either from other cells in the ordinary filaments or otherwise in small "dwarf male plants," which appear to be developed from the zoospores above described, and of which numbers may be often seen parasitic upon the larger plants. [Plate II., Fig. 11.]

[TO BE CONTINUED.]

SCIENTIFIC NAMES.—I. FORM.

BY W. B. GROVE, B.A.

(Continued from page 124.)*

The third declension differs from the other two, and presents some difficulty. Words of this class have many terminations, but they rarely end in *-a*, *-e*, or *-er*, never in *-um*. It is chiefly those ending in *-us* that can be mistaken. The peculiarities of the third declension are that the genitive singular always ends in *-is*, and has very often one syllable more than the nominative; the plural ends in *-a* or *-es*, according as the word is, or is not, neuter. It is an invariable rule that the plural of a neuter word ends in *-a*. For most of the words of this class recourse must be had to the dictionary, but the following table of the chief forms may be useful. Notice that the true stem seldom appears in the nominative, but may be obtained from the genitive by removing the termination *-is*. Though there are rules for determining the gender, the only safe course is to refer to the dictionary. Examples of the fourth and fifth declensions are added for the sake of completeness.

NOUNS.

	Singular, Nominative.	Genitive.	Plural Nom.	Genitive.
III.	Ovis, *f.*, a sheep.	ovis.	oves.	ovium.
	Iris, *f.*, part of the eye.	iridis.	irides.	iridum.
	Naias, *f.*, a naiad.	naiadis.	naiades.	naiadum.
	Salix, *f.*, a willow.	salicis.	salices.	salicum.
	Carex, *f.*, sedge.	caricis.	carices.	caricum.
	Plantago, *f.*, plantain.	plantaginis.	plantagines.	plantaginum.
	Senecio, *m.*, groundsel.	senecionis.	seneciones.	senecionum.
	Dens, *m.*, a tooth.	dentis.	dentes.	dentium.
	Foramen, *n.*, an opening.	foraminis.	foramina.	foraminum.
	Genus, *n.*, a kind.	generis.	genera.	generum.
	Animal, *n.*, an animal.	animalis.	animalia.	animalium.
IV.	Quercus, *f.*, an oak.	quercus.	quercus.	quercuum.
V.	Species, *f.*, an appearance.	specieï.	species.	specierum.

The only important adjectives of this type end thus:—

ADJECTIVES.

Singular.			Plural.		
m.	*f.*	*n.*	*m.*	*f.*	*n.*
-is.	-is.	-e.	-es.	-es.	-ia.
-or.	-or.	-us.	-ores.	-ores.	-ora.
-ns.	-ns.	-ns.	-ntes.	-ntes.	-ntia.

Thus we have *Carduus palustris*, *Viola palustris*, but *Comarum palustre*; *Lotus major*, *Astrantia major*, but *Arctium majus*; *Ranunculus repens*, *Linaria repens*, and *Trifolium repens*; as an example of the plural we may take *Rodentia*, the rodent animals.

There are many Greek words also in use, but in many or most cases they are Latinised, and will come under the rules already given. Only two, which do not, can be mentioned here.

* ERRATUM IN MAY NUMBER (p. 124, bottom line.)—For "polyzoon," read "polyzoan," after the analogy of entomostracan, infusorian, &c.

NOUNS.

Singular Nominative.		Genitive.	Plural Nom.	Genitive.
II.	-on, *n.*	—	-a.	—
III.	-ma, *n.*	-matos.	-mata.	-maton.

Examples are found in *polyzoön*, plur. *polyzoa*, and *stoma*, plur. *stomata*, the stem of which, as is the case in all Greek nouns ending in *-ma*, is formed by adding *t* to the nominative.

Having obtained the stem of a word, of whatever declension, if we wish to form a derivative, we add to it any termination which expresses the required idea. The only point of importance occurs when this termination begins with a consonant. In this case the letter *i* is generally inserted, if the word is of Latin, and the letter *o*, if it is of Greek origin. Thus from the Latin *heder-a*, "ivy," we get *heder-aceus* and *hederi-folius*; but some botanists, wishing probably to retain the *a*, write *hederæfolius*. For this there seems to be no classical authority whatever, and it should therefore be avoided, as founded upon a mistaken idea. Other examples are *Boragin-aceæ*, from borago, *linarii-folius*, from linaria, *anagallidi-folius*, from anagallis, *formici-forme*, from formica. As before, some entomologists write *formicæ-forme*, but the very same persons spell *tipuliforme*, from tipula, without the *æ*. Similarly from the Greek we get *chloro-phyll*, *morpho-logy*, *Gastero-poda*, &c. This inserted *o* generally serves as a mark that the roots from which the word is derived are Greek; I say generally, because some words, as Fungology, are hybrids, *Fungus* being a Latin, and *logos*, a Greek word. There is one case where this *o* is inserted, which is seldom suspected. Thus *hypnoides* is compounded of *hypn-um*, a moss, and the termination *-ides*, meaning "resembling, similar to." This termination was used by the Greeks, but, since in very ancient times it began with a consonant having a sound like *f* or *v*, it required the insertion of *o* before it. Thus we should get *hypno-fides*. This consonant, (called the "lost" Digamma,) ceased to be used by the Greeks thousands of years ago, but they still retained the *o*, and we follow their example. Thus the *o* and *i* in *hypnoides* belong to distinct syllables: the importance of this will be seen when we come to pronunciation. There are many words used in scientific English of the same kind, *e.g.*, albuminoid, anthropoid, and botryoid. The same termination is sometimes used in the plural in the names of sections of the animal and vegetable kingdoms; thus Crinoidea, from *crin-on*, "a lily," is really crino-idea, and means "lily-like" animals, and Aroideæ, from *ar-um*, the cuckoo-pint, means "arum-like" plants. There is another class of words, apparently similar, but really of a different origin, those ending in *-idæ* or *-iadæ*, which must not be confounded with those just mentioned. This latter termination was used to designate the children and remoter descendants of any person; thus the Pelopidæ were the descendants or family of Pelops, and the meaning with which it is employed now is, whether purposely or not, very similar. The Equidæ, for instance, are the descendants of some common original form, which existed in geologic times, to which indeed the name Equus could not be applied, but which was the type and first foreshadowing of

the group of animals to which we now restrict the name, and so far the idea suggested by these terminations is applicable to the case. It may be noticed that it is customary to use *-iadæ* for all words ending in *-ia*, as Crania, Craniadæ, and for all others to affix *-idæ* to the true stem, as Mactra, Mactridæ; Helix, Helicidæ; Bos, Bovidæ. As usual this rule is sometimes, though without reason, infringed, as in Cerithium, Cerithiadæ; Arca, Arcadæ.

Something, also, must be said about specific names, which are not adjectives. First among these are the so-called complimentary names, used in the genitive case. When the name of a modern man or woman is to be Latinised, the usual plan is to add *-us* or *-ius*, as may be most euphonious, for the one, and *-a* or *-ia* for the other, with the ordinary genitives. This, of course, does not apply to complimentary generic names, *e.g.*, Linnæa, Hookeria, which are always feminine. Thus, *Rafflesia Arnoldi* means "Arnold's Rafflesia," and commemorates not only Dr. Joseph Arnold, its discoverer, but also Sir Stamford Raffles, the Governor of Sumatra at the time of its discovery; in *Lepidium Smithii* two *i*'s are used to produce a smoother sound; *Nitophyllum Hutchinsiæ* is Miss Hutchins' Nitophyllum. These should always be spelled with a capital letter, as also should adjectives derived from proper names, but in this latter respect practice differs. Both *Silene Anglica* and *S. anglica* are found, and some have even ventured to write *hookerianus*. It may be presumed that this license, so foreign to both the English and the classical tongues, has been imported from the Continent, as it is in accordance with the usage of the French and other languages. Still another class of specific names should be written with a capital initial, those which are nouns in the nominative case, which have been for the most part originally the names of genera, as in *Potentilla Tormentilla*, *Poterium Sanguisorba*, *Hipparchia Tithonus*. The last two instances show pointedly that these, not being adjectives, do not necessarily agree in gender with the generic name. There is, finally, the class represented by *Pieris brassicæ*, which means the Pieris "of the cabbage," because the larva of that butterfly feeds upon the cabbage. These should, properly, not be spelled with a capital, (though this is sometimes done,) and are in the genitive case, either singular or plural. They are most common among the names of Lepidoptera, as *Anthocharis cardamines*, *Sphinx convolvuli*, *Thecla quercus*, but are not wanting in other places. Thus *Rosa dumetorum* means the rose "of the thickets;" *Æcidium compositarum*, the Æcidium "of the Compositæ;" and, to take an example from the "Midland Naturalist" of March, *Amphistoma hominis*, the Amphistoma "of man."

In order to find out the meaning of a scientific term, it is necessary for one not accustomed to the search to form first some idea of the kind of word he has in hand, in doing which it is hoped the previous observations will be of use. The word should then be looked out in the dictionary as a whole; if it be not found, as will very often be the case, it must next be considered what are its probable component parts. In this the inserted *i* or *o* is of great assistance, nor should the help which

can be obtained from comparison with other words be neglected. Thus the common adjectival terminations, *-osus*, *-ilis*, *-inus*, *-anus*, *-arius*, *-atus*, &c., can be recognised, and their meaning arrived at by the consideration of English words of a similar ending. Moreover, if one or more syllables are found to occur in many different words, it may be presumed that they form a root; compare Cardium, Cardita, Cardiomorpha, and with the latter Callimorpha; Apteryx, Micropteryx, and Microspore; Diplacanthus, and Acanthoides. These parts should then be looked out separately; but there will often be a considerable amount of search required, and after all there will remain some, the derivation and meaning of which none but a practised investigator could discover, not to mention those which are incorrectly formed, and have in their present shape no meaning whatever. The chief difficulty lies in the Greek roots, for investigating which it is necessary to be acquainted not only with the value of the letters of the Greek alphabet, but also with the conventional changes which are made in expressing a Greek word in English letters. The chief are given below:—*κ* is generally represented by *c*, *υ* by *y*, *ου* by *u*, *ει* by *i*, *αι* by *æ*, and *οι* by *œ*. The last two are often further degraded into *e*, as the word becomes more Anglicised, *e.g.*, palæozoic, paleozoic. Here again, of late years, innovations have been made, the result partly of carelessness, partly of a desire to keep more nearly the supposed ancient pronunciation. Thus diœcious and monœcious are sometimes written dioicous and monoicous, the *οι* being represented by *oi*, instead of by *œ*; similarly the first syllable of Cainozoic is really the same as the last syllable of Eocene.

It may, perhaps, illustrate the analytic process of finding the derivation of a given word, if we show the reverse, synthetic method of forming a word to represent a given idea. Thus, suppose we wish to invent a generic name which shall mean "cleft-tooth," we find the Latin for "cleft" is *fiss-us*, for "tooth" *dens*. As the *dens* is to go last, we shall use, not the true stem *dent-*, but the nominative case; placing the two syllables together, and inserting *i*, we get Fissidens, the name of a genus of mosses which has the peristome-teeth cleft half-way down. Then comes the question, what is to be the gender of Fissidens. On this point the rule is clear and precise: it must have the same gender as the last component, *i.e.*, since *dens* is masculine, Fissidens is masculine also. If, however, any termination is added, which generally ends in *-us*, *-a*, or *-um*, it is masculine, feminine, or neuter accordingly. For instance, from the same word *dens* we get Dentaria, which is feminine.

There are too many words in scientific language which are not formed according to these principles, but still the vast majority obeys them, and it is for this reason that they concern all students of science, for upon them in great measure depends the pronunciation, as has been already pointed out in one case, and will be further illustrated in the following papers. In conclusion, it may be added that the rules have been founded in every case upon the practice of the best authorities, and, though many points have been omitted for want of space, it is believed that all the chief variations of usage have been included.

DIGGING OUT A BOULDER.

BY W. J. HARRISON, F.G.S.

A few days since an eminent Geologist remarked to me—"Twenty years ago I thought I knew all about the drift; now I am doubtful if I know anything certain about it." In fact, the more those surface deposits which we assign to the glacial period are studied, the more difficult does the problem of their precise origin become. In Leicestershire we find the oldest glacial deposits to be beds of sand and gravel, which are seen at certain points to be *overlaid* by a stiff, clayey mass, full of stones of all sorts and sizes, to which the name of the "Great Chalky Boulder Clay" has been assigned, from the number of fragments of chalk which it contains. This arrangement holds good elsewhere, but both on the east coast, (Lincolnshire, &c.,) and the west coast, (Lancashire, &c.,) the sandy, gravelly deposits are *underlain* by a clayey deposit, or Lower Boulder Clay, which is absent in Leicestershire.

In the Upper Boulder Clay of this county there are many fine masses or erratic blocks, some of which are referrible to the Mountain Limestone, others to the Millstone Grit or carboniferous sandstones, still others to the Lower Oolite, but the finest masses are decidedly those from Charnwood Forest, as we might expect from its immediate proximity. Of rocks foreign to England no authenticated instance has ever occurred.

Of the Charnwood Rocks none are more readily recognisable than those of Mountsorrel, under which name I include the entire igneous mass which covers about one square mile of surface in the vicinity of the famous quarries. The stone is a hornblendic granite, finely crystallised, and of a pink or grey hue according to the tint of the felspar. Erratic masses of this rock occur at intervals along a definite line on the east side of the Soar Valley, a line which is marked by the occurrence of some very fine blocks.

Some of these boulders have attained to the dignity of a mention in the pages of the historian, and among these is the mass whose disinterment I am about to describe.

It is situated in a field 2¾ miles north-east of Leicester, and on the north side of the road from Humberstone to Thurmaston. Here it lies nearly on the top of the low ridge of Rhaetic Beds and Lower Lias, which forms the eastern boundary of the Soar Valley. The boulder clay in which it is embedded rests on the Lower Lias, the mid-glacial deposits being absent. Mountsorrel bears north-west, and is on the *west* side of the Soar Valley, which the boulder has consequently crossed. The spot where it now lies is about 260ft. above the level of the sea.

In Nichols' History of Leicestershire, (Vol. III., p. 981,) this stone is referred to by the Rev. Mr. Woodcock, who says that there is a tradition that a house, or cell, or nunnery, having some underground connection with the Abbey of St. Mary de Pratis, in full view of which it would stand, was once situated here. The block was called "Hellstone," or "Holstone," and the field "Hoston Field," a word which seems to be a

corruption of "Holystone." The boulder lies fifty yards within the field, not far from a hedge. Before being uncovered its visible mass was insignificant, being lichen-covered and rising only some seven or eight inches above the grass, with an area of 2ft. by 3ft., but that it extended under the turf for some distance was evident from the dryness of the surrounding patch in winter, and the burnt appearance of the grass in summer.

Nichols also tells us that this stone "seems to confirm the generally received opinion of Naturalists concerning the growth* of these bodies; for, notwithstanding great pains have been taken by a late proprietor of the land to keep it below the surface, it defeats his efforts, and rises gradually, though not insensibly." The Holstone is nearly three miles distant from the site of "St. John's Stone," another fine mass of Mountsorrel granite, which formerly stood in a hollow in a field near Leicester Abbey. A line joining these two masses was said to point to the rising place of the sun on Midsummer-day. It would bear two or three degrees north of east.

The occupier of the field—Mr. Kirby, of Humberstone—who is a member of the Leicester Literary and Philosophical Society, kindly undertook to have the stone uncovered, and invited a party of gentlemen interested in Geological and Archæological pursuits to view its bared proportions. On arriving on the ground on the afternoon of May 2nd, I found that a trench had been dug completely round the boulder. It was now seen to be a pentagonal mass, the sides measuring 7ft., 5ft., 6ft., 4ft., and 5½ft. respectively. Its height varied from 4ft. 9in. to 3ft. 6in. Now the average specific gravity of the Mountsorrel granite is 2·659, and, consequently, each cubic foot weighs 166·19 pounds. Taking the contents of the boulder at 200 cubic feet, we find its weight to be in round numbers fifteen tons. The matrix in which it was embedded was boulder clay of the ordinary description, rather sandy in the upper part, and full of rounded quartzite and grit pebbles from three to six inches in diameter, with broken liassic fossils, also pieces of mountain limestone, millstone grit, &c. The sides of the boulder are clean and sharply defined, evidently traversed by master-joints. No striations were visible, but they may possibly exist on the under-surface. Its top is worn into rounded hummocks, just as the summits of the syenite hills of Charnwood now weather. I have, indeed, little doubt that this mass formed a part of the then summit of Mountsorrel, when a glacier advancing southwards tore it from its home, carried it over a depression in the Soar Valley of more than 100ft., and finally dropped it at a point six miles distant from its native mass.

* The apparent growth of boulders is thus referred to in the report of the British Association Boulder Committee. "It should be mentioned here that boulders gradually 'work up' to the surface. This is due, no doubt, to denudation which is taking place. In a field on Red Hill Farm, between Stafford and Stone, is one of the largest boulders of the district. This boulder was not noticed till some twenty years ago, when it was found to obstruct the plough, although still some depth underground. The obstruction became more and more serious each year until, in consequence of this impediment, the field was turned from an arable to a grazing one. At this time the boulder rises about 1ft. above the level of the field. The part exposed measures 6ft. by about 5ft., and evidently extends under the turf for a much greater distance."—Report 1878, p. 193.—Eds. M. N.

It would be very desirable, if possible, to remove the "Holstone" to the grounds of the Leicester Town Museum, where it would be secure from destruction, and where its ponderous proportions would form an object well fitted to attract the attention of visitors, and to awaken a desire in their minds to study the science of Geology.

Many thanks are due to Mr. Kirby for his energy in the matter, and for the hospitable manner in which he entertained the party who came to inspect his "little stranger."

THE TAMWORTH TREASURE TROVE AND THE TAMWORTH MINT.

BY ARTHUR A. CLARSON.

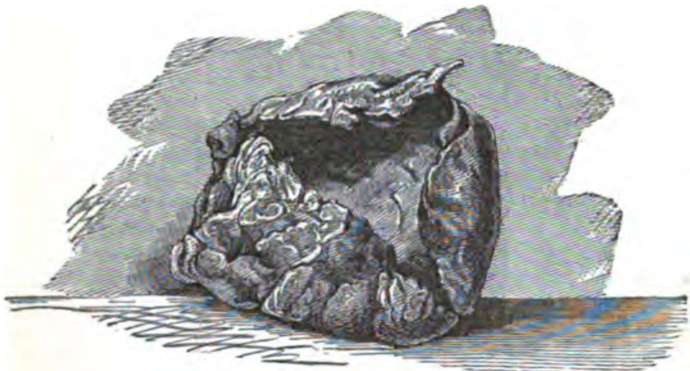


Fig 6.

The interest which has been excited by the recent discovery at Tamworth of coins of the date of the two first Williams, leads me to suppose that an account of the "find" would not be unacceptable. Nor do I think such an account out of place in a magazine especially devoted to the Natural History, Archæology, &c., of the district in which they were found.

A disquisition on the Antiquities of Tamworth would be foreign to the subject, yet some reference must be made, as they are indirectly connected with the discovery and rescue of the coins. Tamworth is the most ancient town in the county of Stafford, says the learned and pedantic Dr. Plot. We have, probably, an Ancient British mound, on which stands the present Castle, the keep of a former extensive fortalice. Roman remains are found in the vicinity, and the town itself is encompassed by a quadrangular castrametation, consisting of earthworks with a fosse, attributed to the Saxon period. It was also a seat of the Mercian Kings, an important place in the reign of Alfred the Great, the scene of the marriage of the sister of Athelstan, was thrice sacked by the Danes, and rebuilt by the "Ladie of the Mercians," Ethelfleda; few towns, indeed, can boast of such a history as the "ancient and loyal" borough of Tamworth.

The castrametation before alluded to is supposed to be of Saxon origin, but, with a view of further proving the question, some members of the Tamworth Natural History, Geological, and Antiquarian Society sunk a shaft in a mound in the north-eastern angle, the result of their efforts being somewhat indecisive. In the same field, however, but a short distance off, one of the workmen engaged in excavating for the foundation of a wall in connection with the new schools, turned up with his pick the leaden casket containing the coins. I had timely information of the discovery, and was fortunately enabled to rescue this valuable "find" from dispersion.

The casket, of which a representation is given, (through the kindness of Mr. B. V. Head, of the British Museum,) was formed of a piece of beaten lead, turned over on three sides, something like a "turn-over tart," and, on being opened, was found to contain 294 silver pennies of the reigns of William I. or William II. These were afterwards taken to London by the Vicar of Tamworth, the Rev. Brooke Lambert, and delivered up as "Treasure Trove." The authorities of the British Museum selected 103 for the National Collection, 41 were appropriated by the Royal Mint, and the remainder returned to Tamworth.

The coins were of four distinct types, Hawkins 242, 244, 245, (three coins only,) and 246. No. 242 is the well known "paxs" type usually attributed to William the Conqueror—the obverse, head, full faced, bust extending to edge of the coin, right hand bearing a sceptre is crossed over the bust, so that the sceptre appears on the right of the coin the proper left of the figure, sceptre has a cross *paté* at the top, the shaft foliated, on the head a crown with labels or "ear drops," over the right shoulder three mullets, inscription PILLELM REX. Reverse, cross *potent*, a small circle in each of the quadrants, one letter of the word P. A. X. S. in each circle; circumscribed is the moneyers name and place of mintage.

The second type of coin, Hawkins 244, has the head in profile looking to the right, sword in right hand, mullets on each shoulder, bust extending to edge, inscription as before. Reverse, cross *potent* with fleur-de-lis in the quadrants, moneyers name and place of mintage.

The third type, Hawkins 245, (three coins only,) I had not noticed before the collection left my hands.

The fourth type, Hawkins 246. Head full faced and crowned, labels at the ears, sword in right hand on proper right of figure, left side of coin, mullet on left shoulder, bust extending to edge, inscription as before. Reverse, cross *potent* in a compartment formed by four semi-circles having pellets at the intersections, moneyers name and place of mintage.

The greatest interest is attached to the moneyers name and places of coinage. No less than 42 towns are represented in the Tamworth find. In explanation of this it may be as well to mention that the Saxon Kings granted the privilege of coining to their subjects, and this custom was continued through the Norman period. Canterbury had seven mints, London eight, Rochester three, Winchester six, Lewes, Hastings, Wareham, Exeter, Shaftesbury, and Hampton each two, and in every good town one coiner, the stamp being provided by the King. The

following is the list of the towns represented in the find, with the number of coins of each town:—

Bedford	4	Lewes	1	Stafford	6
Bristol	4	Leicester	16	Steyning	1
Cambridge	1	Lincoln	6	Sta (?)	1
Canterbury	2	London	52	Tamworth	33
Chester	9	Maldon	1	Thetford	2
Chichester	4	Malmesbury	4	Wallingford	6
Colchester	1	Norwich	5	Warwick	19
Derby	4	Nottingham	2	Wilton	5
Dorchester	3	Oxford	5	Winchester	10
Dover	1	Rochester	2	Worcester	12
Exeter	2	Salisbury	7	York	3
Gloucester	3	Sandwich	1	Wv (?)	1
Hastings	2	Shaftesbury	1		
Hereford	7	Southampton	5	Uncertain Mints	14
Ilchester	3	Southwark	5	Illegible	18

The following is a list of the moneyers in, and the contractions used for, the towns in the midland district:—

William I. (Hawkins 242.)	William II. (?) (Hawkins 244.)	(Hawkins 245, 246.)
	Derby.	
	GODI . . . ON DERBI	GODPINE ON DERE
		GVDNIC ON DRBE
		LIFPINE ON DRBI
	Hereford.	
ÆGLPINE ON HRE	ÆLFPI ON HRFERI	ÆGLPINE ON HRI
LIESTIIII ON HRE		LIFSIIN ON HREF
	Leicester.	
	LIFPINE ON LEICGI	ÆLFPINE ON LEI
	LIFINC ON LECIEI	LIFIC ON LEIEI
	SENOLF ON LE . ST	LIFIC ON LEIECES
		LIFINC ON LEICEI
		LIFINCONLEIECES
		LIFPINE ON LEICE*
		LIFPINE ON LEICI
		SVNOVLF ON LEG
		SVNOVLF ON LEIC
		SVNOVLF ON LEIEI
	Nottingham.	
	PI......ON SVOTINC(?)	VCERE ON SOTINGE
	Oxford.	
BRIHTRED ON OXN		BRVNRÆD ON OXEI
		SP . . . PINE ON OX
		PVLLPI ON OXNE
		. . . . PINE ON OXEI
	Stafford.	
	GODRICONSTAFRE	ÆLFNOD ON STF
	GODRICON ST . . . D	ODRIC ON STFRDI
	Tamworth.	
	BRVNIC ON TAMPR	BRVNIC ON TAMP
	COLIN ON TAMPR	CVLINC ON TAMP
	COLINC ON TAMPR	
	Warwick.	
LIFRIC ON PERI	GOLDINC ON PER	GOLDINC ON PERE
	GOLDINC ON PERI	GOLDINC ON PERP
	LIFRIC ON PRPI	SPERMANIC ON PRI
	DIDRED ON PRPICE	SPERMANIC ON PRI
		DIDRÆD ON PRIP

* Hawkins, 245.

William I.	William II. (?)	
(Hawkins 242.)	(Hawkins 244.)	(Hawkins 245, 246.)
	Worcester.	
	BALDRIC ON PIHR	BALDRIC ON PIHR
	ESTMÆR ON PIHR	ESTMÆR ON PIH
		ESTMÆR ON PIHR
		GODPINE ON PIHR
		SEPINE ON PHRI*

Speculation as to the cause of the deposit in the place where it was found would be futile. There is no doubt it was a local hoard from the number of coins of the Tamworth mintage, and a few notes on the Tamworth Mint will properly conclude this article.

The revered historian of Tamworth, Charles Ferrers Palmer, says that the name as a place of mintage first appears upon a penny of Eadweard the Martyr, (975,) as TANWO. A coin of Canute the Great is mentioned by Pitt in his History of Staffordshire, having on the reverse EDRIC ON TAM; *i.e.*, "Edric, Moneyer in Tamworth."

The next reign of which coins of Tamworth are extant is that of Edward the Confessor, in which the name appears as TONWVRTH and TONWYRTH. The only specimen of the Confessor's coinage issued from Tamworth with which Palmer was acquainted, is a silver penny, bearing on the obverse the inscription EDWARD REX, and on the reverse, BRVNING ON TAM.

I am indebted to Mr. J. Thompson for the use of the block of this coin, which was cut for Palmer's History of Tamworth.

Fig. 7.—Silver Penny of Edward the Confessor.

Ruding mentions some coins of Harold bearing the contraction TAN, which he conjectured to be either Tamworth, or Taunton in Somersetshire.

After the Conquest, says Palmer, the Royal Mint at Tamworth was in activity until the time of Henry I., in whose reign it was discontinued. (Ruding). Through Mr. Thompson's kindness I am also enabled to give a representation of another Tamworth coin of William the Conqueror, (or William Rufus ?), which differs from those in our recent find.

Fig. 8.—Silver Penny of William I. (or II. ?).

* In each case the Saxon character, the Wen is used for W, and in this article the Roman P, which it resembles, is substituted.

On the obverse PILLEMV REX, and on the reverse BRVNING ON TANPI.

Bruning was a coiner, or moneyer, of Tamworth in the time of Edward the Confessor, and continued in the reign of William II.

Pitt mentions another silver penny of William II. having on the reverse IELFPINE ON TAM.

RAPHIDES AND PLANT CRYSTALS.*

BY MRS. G. R. COWEN.

Deposits of mineral matter in a crystalline form are frequently found in vegetable cells, where they are at once brought into view by the use of polarised light. They are commonly termed Raphides, or needle-shaped bodies, a term inappropriate to many of them, in which the crystals are of different forms, often prismatic or stellate.

As early as Malpighi's time, Raphides had been observed in plants, and at later periods they engaged the attention of Quekett, Lindley, Schleiden, and others, but they appear to have looked upon them as products of disease, or an accidental circumstance in the economy of the plant. The first to reduce to something like order, and to indicate the value of plant crystals, both as a constant and intrinsic result of the healthy life of certain plants, and also in determining the differences between species, was Professor George Gulliver, by whom they have been arranged in three groups, viz.: Raphides, Sphæraphides, and Crystal prisms.

The crystals are mostly composed of oxalate of lime, sometimes with magnesia. In other instances the calcareous base is combined with tartaric, citric, or malic acid, and the acicular crystals usually consist of phosphate of lime.

Raphides are slender, needle-shaped crystals, with rounded smooth shafts vanishing at each end to a point. About ten to fifty or more lie parallel together, so as to form a bundle which partially fills a cell, or intercellular space. When undisturbed, this bundle lies along its cell, but the Raphides are so easily displaced by slight pressure that either all or part of them cross the cell in various directions, sometimes escaping from the ends. The raphis-cell is commonly very distinct, often oval, and contains some viscid, semi-fluid substance, in the midst of which lies the bundle of Raphides. The raphis-bearing plants among our native exogens belong to three orders, Galiaceæ, Balsaminaceæ, and Onagraceæ, and there is not a single instance of any species belonging to these orders without Raphides.

The Fuchsia belongs to the order Onagraceæ, and is a great raphis-bearing plant, quantities being found in the leaves, the berry-pulp,

* Abstract of a paper read by Mrs. Cowen before the Natural Science Section of the Nottingham Literary and Philosophical Society, on April 3rd, 1878.

and even in the ovule. In this order, even the seed-leaves, fragments of stem, as well as parts still alive underground during the winter, may be easily known by their Raphides from plants of other and closely allied orders.

None of our exogenous trees or shrubs have, up to the present time, been found to produce Raphides, but they are present in many exotic trees and shrubs of this class. In the order Vitaceæ, of which the grape vine and American creeper are common representatives, we find both Raphides and Sphæraphides in the leaves, young shoots, ovaries, and ripe fruit. Our dictyogens abound in Raphides, as may be seen in the Black Bryony and Herb Paris. In the former they appear loose and destitute of a cell, both in the ripe berry-pulp, and the root stock. This root is like a little yam, and the yams so commonly used as food in the West Indies belong to this class, and contain Raphides.

The sarsaparilla of the shops affords Raphides, but not so the American or false sarsaparilla, which is one of the Araliaceæ, abounding in Sphæraphides.

In the other classes of our endogens, Raphides are more abundant than in our exogens. They are plentiful in the Hyacinth, the Star of Bethlehem, the Cuckoo-pint; also in the Lily of the Valley, the Asparagus, and in the Daffodil and other Amaryllids. We find them plentifully in most species of Duckweed, without the protection of a proper cell wall, the boundary of the space being formed merely by the outer walls of the contiguous tissue-cells. Raphides also occur in the English Orchidaceæ. They vary in length from 1-27th of an inch to 1-500th of an inch.

Sphæraphides are more or less rounded forms, made up of a number of crystals, commonly opaque and whitish. They are generally rough on the surface, from the projections there of the crystalline angles. They vary very much in size in the same plant, and still more in different orders, and are universally diffused through Phanerogamia. Some plants of the Cactus tribe, when aged, have their tissues so loaded with them as to become quite brittle. The leaves or stem of the Hop, Nettle, and many Goose-foot weeds, are good plants for Sphæraphides; and so are the Begonias of our greenhouses. They are very large in the Prickly Pear.

Crystal prisms are also acicular forms, but seldom occur more than two, three, or four in contact, and then closely side by side, as if partially fused together. They are more frequently strewed singly throughout the plant tissue, and sometimes, as in the bulb-scales of Shallot, they form crosses. They are generally larger than the Raphides, and can be plainly seen to possess three or four faces or angles; they do not taper at the ends like the Raphides, but their tips are either pyramids, or like a carpenter's chisel, or wedge-shaped, or the ends may be truncate, an appearance often caused by fracture. These crystals, when they lie in contact, are not easily separable from each other, or from the tissue in which they are seated, and when the cell can be seen it is closely

investing the prism. In size they vary from 1-25th inch, and thickness of 1-532nd inch, in the Florentine Iris, to a length of 1-1000th inch, and thickness of 1-6400th inch in the ovary coat of *Centaurea nigra.*

These prisms are small but distinct in the ovary coat of many Compositæ, as the Thistle, Knapweed, &c., but large ones occur in many exotic exogens, of which examples may be seen in the barks of Quillaya and Guaiacum. They are frequent in endogens as in the common purple Flag, and many other Iridaceæ, and often appear in the same plant with Raphides, as may be seen in certain Amaryllids; they can be well seen with polarised light.

Although the precise use of these crystals in the vegetable economy is obscure, we may conclude that whatever is constant in a plant must be important. And when we consider how commonly plant crystals are composed of phosphate or oxalate of lime, or some other compound of this earth, and its value in the growth or nutrition of animals and vegetables; and that they are plentiful in many plants which form the food of birds and mammalia, and food and medicine for man, we get a glimpse of the use of these crystals. Raphides are useful in systematic botany in distinguishing between species. We can also easily see why the gardener collects decayed leaves for his composts, and why such plants as abound most in crystals are the most valuable for the purpose. The above account has been compiled from various articles by Professor Gulliver, in the "Microscopical Journal," "The Annals of Natural History," and other scientific journals.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF APRIL, 1878.

BY. W. J. HARRISON, F.G.S.

The weather of April last has elicited encomiums from nearly all our observers. The first ten or eleven days were cold and frosty, the night of the 1st being the minimum at nearly all stations. This frost cut off the apricots, early plums, and gooseberries. After the 10th a warm and genial period set in, which continued to the end of the month. Easterly winds prevailed, but the barometer was by no means high. Thunderstorms occurred on the 5th, 17th, 25th, and 30th. Rainfall again below the average; the only stations whose maximum fall exceeded one inch being Whitfield (1·25in.) and West Malvern (1·24in.,) both on the 10th, which day produced the extreme fall at several stations in the west and in the south of England generally. In London on the 11th from 2 to 2¾ inches fell in twenty-four hours, with a light easterly wind, but this was quite local. In the midlands generally the 20th gave the maximum fall, though this was not of very large amount. This was a very unsettled day, and marked by a change of wind from south-west to east.

As to vegetation all things look promising. The oak and elm are both leafing before the ash, giving promise (according to the proverb) of a fine summer. The apple, pear, strawberry, and late plum are making a wonderful show of blossom, and in the hedges the blackthorn has made a good show.

STATION.	OBSERVER.	RAINFALL. Total for M.	RAINFALL. Greatest fall in 24 hours.		RAINFALL. No. of rainy days	TEMPERATURE. Greatest ht.		TEMPERATURE. Great'st cold	
		In.	In.	Date.		Deg	Date.	Deg	Date.
GLOUCESTERSHIRE.									
Cainscross, Stroud	W. B. Baker, Esq.	3·92	·97	10 & 11	14	64·0	17	24·0	1
Cheltenham	R. Tyrer, Esq.	3·27	·84	10	18	66·0	27 & 30	22·4	1
Stroud	S. J. Coley, Esq.	3·56	·87	10	18	68·0	28 & 30	28·5	5
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	1·98	·47	23	15	63·0	29	25·0	1
Whitchurch	A. B. George, Esq.	1·97	·50	20	13	67·0	30	32·0	25
Woolstaston	Rev. E. D. Carr	1·85	·27	17	20	69·0	30	24·5	1
Leaton Vicarage, Shrewsbury	Rev. E. V. Pigott	2·10	·59	23	19	66·0	28	25·0	1
More Rectory, Bishop's Castle	Rev. A. Male	1·50	·31	19	19	65·0	28 & 30	23·0	1
Larden Hall, Much Wenlock	Miss F. R. Boughton	1·66	·40	10	20				
Bishop's Castle	E. Griffiths, Esq.	1·33	·22	29	19	65·0	28	23·0	5
Cardington	Rev. Wm. Elliot	1·77	·31	10	16				
Adderley Rectory	Rev. A. Corbet	1·94	·50	19	15				
Stokesay	Rev. J. D. La Touche	1·22	·19	29	19	64·1	30	23·4	1
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	3·36	1·25	10	20				
Stoke Bliss	Rev. G. E. Alexander	2·58	·62	10	17	64·0	30	31·0	3
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq.	2·56	·48	10	20	65·2	30	25·3	1
West Malvern	A. H. Hartland, Esq.	3·12	1·24	10	17	68·0	28	31·0	1
Pedmore	E. B. Marten, Esq.	2·24	·43	20	14	65·0	27 & 28	32·0	3 & 6
Stourbridge	Mr. J. Jeffries	2·37	·44	20	16	68·0	19 28 29	24·0	3
St. John's, Worcester	G. B. Wetherall, Esq.	2·55	·56	10	16	64·0	29 & 30	26·0	1
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	2·27	·41	29	14				
Barlaston	W. Scott, Esq.	1·91	·41	20	11	66·0	29	21·8	2
Amblecote	Mr. J. Robins	1·95	·44	20	15	81·0	22 & 23	29·0	5
Dudley	Mr. J. Fisher	2·14	·42	20	14	68·0	28 & 29	28·0	1
Sedgley	Mr. C. Beale	2·11	·36	20	15	62·0	28 & 29	32·0	3
Kinver	Mr. W. H. Bolton	1·96	·33	20	15	69·0	29	27·0	6
Walsall	Mr. W. E. Best	2·06	·58	20	15	63·0	28	32·0	3 5 & 6
Grammar School, Burton	C. U. Tripp, Esq.	1·88	·42	19	15	68·0	28	25·0	1
Patshull Gardens	T. W. Dell, Esq.	1·95	·33	18	11	70·0	28	24·0	1
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	1·98	·47	23	17	68·5	28	25·0	1
Wrottesley	E. Simpson, Esq.	2·30	·50	30	14	64·6	29	24·5	1
Tamworth	W. Arnold, Esq.	1·97	·49	20	17				
Alstonfield Vicarage	Rev. W. H. Purchas	1·79	·37	19	10	65·2	29	19·0	25
Tean Vicarage, near Cheadle	Rev. G. T. Ryves	2·26	·43	19	15	65·0	29	25·0	1
The Heath House, Cheadle	J. G. Philips, Esq.	2·20	·45	19	14	64·0	29	25·0	1
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	2·21	·57	20	15	65·0	30	30·0	5
Coventry	J. Gulson, Esq.	2·04	·32	20	15	75·0	29	24·0	1
Bickenhill Vicarage	W. R. Capel, Esq.	1·97	·45	20	14	63·0	27	27·0	1
St. Mary's College, Oscott	Rev. S. J. Whitty	1·95	·41	20	14	64·1	28	26·5	1
Henley-in-Arden	T. H. G. Newton, Esq.	2·67	·52	21	15	67·0	28	23·0	1
Rugby School	Rev. T. N. Hutchinson	1·89	·49	20	18	66·0	29	23·0	1
DERBYSHIRE.									
Buxton	E. J. Sykes, Esq.	2·44	·50	20	13	60·1	14	28·4	1
Brampton S. Thomas	Rev. J. M. Mello	1·56	·65	20	11	65·0	29 & 30	24·0	1 & 5
Stoney Middleton	Rev. U. Smith	1·86	·45	20	13	62·0	28	20·0	5
Fernslope, Belper	J. G. Jackson, Esq.	1·47	·45	20	13	64·0	28 & 29	25·0	1
Matlock Bath	R. Chadwick, jun., Esq.	1·56	·58	20	12	60·0	28 & 29	23·5	1
Linacre Reservoir, Ches'field	C. E. Jones, Esq.	1·57	·59	21	12				
Willesley Gardens, Cromford	J. Tissington, Esq.	1·56	·74	20	7				
Stuffynwood Hall	Mr. R. Rolfe	1·56	·65	20	13	68·0	14 28 29	29·0	6
Spondon	J. T. Barber	1·20	·46	20	10				
NOTTINGHAMSHIRE.									
Hodsock Priory, Worksop	H. Mellish, Esq.	1·75	·99	20	10	65·3	29	24·0	1
Grove House, Mansfield	W. Tyrer, Esq.	1·53	·61	20	14	65·0	29	25·0	1
Tuxford	J. N. Dufty, Esq.	1·77	1·00	20		65·0	28	32·0	2 3 & 4
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	1·76	·49	20	12	66·8	28	24·0	5
Ashby Magna	Rev. E. Willes	1·58	·44	20	12	72·0	29	26·0	1
Market Harborough	S. W. Cox, Esq.	2·20	·55	20	12	63·0	30	24·0	6
Kibworth	T. Macaulay, Esq.	1·90	·56	20	13				
Town Museum, Leicester	W. J. Harrison, Esq.	1·57	·47	20	14	64·0	29	27·2	1
Belmont Villas, Leicester	H. Billson, Esq.	1·62	·49	20	14	67·[illegible]	28	26·5	1
Syston	J. Hames, jun., Esq.	1·83	·66	20	16	70·0	28	26·0	1 & 6
Waltham-le-Wold	E. Ball, Esq.	1·63	·90	20	11	63·0	29	24·0	1
Little Dalby Hall	G. Jones, Esq.	1·72	·90	20	13	68·0	30	22·0	1
Coston Rectory, Melton	Rev. A. M. Rendell	1·56	·89	20	11	63·8	29	19·0	6
Belvoir Castle	W. Ingram, Esq.	1·48	·91	21	11	67·0	30	25·0	6
Thornton Reservoir		1·46	·40	20					
Bradgate Reservoir		1·51	·44	20					
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	2·36	·46	20	16				
Castle Ashby	R. G. Scriven, Esq.	2·22	·51	20	15	67·0	30	31·0	5
Sedgebrooke	C. A. Markham, Esq.	1·[illegible]5	·50	20	15	71·0	29 & 30	22·0	1
Kettering	J. Wallis, Esq.	1·94	·54	20	12	65·0	30	24·0	1
Althorp	W. F. Jakeman, Esq.	1·71	·41	20	14	67·0	[illegible]0	24·0	6
Northampton	H. Terry, Esq.	1·84	·50	20	13	67·0	30	29·0	5
RUTLANDSHIRE.									
Burley-on-the-Hill	W. Temple, Esq.	1·92	·95	21	13	68·0	28	21·0	1
Tickencote	W. Hayes, Esq.	2·28	·88	20	14	61·0	15	26·0	7
OXFORDSHIRE.									
Radcliffe Observatory	Mr. J. Lucas	2·30	·78	10	11	68·0	30	28·4	5
CUMBERLAND.									
Spital Cemetery, Carlisle	T. Bell, Esq.	2·89	1·27	20	14	68·3	21	27·3	4
ISLE OF WIGHT.									
Ventnor Hospital	Hartley Sagar, Esq.	2·86	·52	10	19	66·3	25	31·8	1
CORNWALL.									
Altarnun Vicarage	Rev. G. Tripp	3·59	·58	1	21	68·0	28	29·0	2

We have received many interesting accounts of the arrival of our migratory birds, and, as the cuckoo and swallow are recorded by numerous observers, their respective times of arrival may be shown in a tabular form:—

	Stroud.	Woolstaston.	More Rectory.	Larden Hall	Bishop's Castle.	Burton-on-Trent.	North Devon.	Malvern.	Tamworth.	Alstonfield.	Kibworth.	Coston.	Castle Ashby.	Sedgebrooke.
Cuckoo........		20	26	30	29	29	16	20			11	23	26	26
Swallow	30	22	23	22	22				22	26		23		25

The nightingale is also recorded from Sedgebrooke and Castle Ashby on the 23rd, and Kibworth on the 18th. At Oscott three sea-gulls were noticed flying from the N.E. at 2 45 p.m., on the 24th. A fine lunar halo was seen on the 12th.

Correspondence.

Brilliant Meteor on April 2nd, 1878, at 7 56 p.m.—Did any correspondent see anything of this last night. It was about 80° high, and of a bluish white colour, very fine and brilliant, and of large size, and came slowly down in a direction a little west of south. I did not see the end of it, on account of a high building blocking the view, but hope other observers were more fortunate.—William Arnold, Tamworth.

Primula Vulgaris.—We have in our garden a number of roots of *Primula vulgaris*, which, so far as I know, have not been moved for several years. Some retain their original colour and form, others have altered to different shades of red, whilst some are white, and in two cases the calyx has become petaloid, a green stripe remaining to represent each sepal. On one plant the inflorescence is an umbel and the flowers are dark crimson, with a cream-coloured spot on the margin of each petal; (I have found a similar inflorescence on the ordinary yellow primrose.) Can any of the readers of the "Midland Naturalist" tell me the reason of these changes?—M. E. C.

Prunella Vulgaris.—I observed the white variety of *Prunella vulgaris* pretty plentifully two years ago near Birnam, in Perthshire, but did not examine it sufficiently closely to say whether it corresponded with the description given of it by Mr. Mott at page 136.—H. F. Johnson, Nottingham.

Moss Catalogue.—It may be useful to the readers of Mr. Bagnall's papers on mosses to know that "The London Catalogue of British Mosses," compiled by C. P. Hobkirk and H. Boswell, 1877, can be obtained of Mr. T. B. Blow, Welwyn, Hertfordshire, price fourpence. It contains a list of the species found in Britain, including those discovered since the publication of "Bryologia Britannica," arranged according to the system of Professor Schimper, who is the greatest authority upon the mosses at the present day.—J. S., Bridgnorth.

The Direction of Rotation.—A small animal, which had received an injury to one hemisphere of the brain, was affected in such a way that it continually rotated upon its own axis, and some time ago a discussion took place as to the direction of this rotation. The question

was whether it rotated from left to right or from right to left, and in the end there seemed to be an opinion that it depended "upon how you looked at it." In a similar way, if a climbing plant is said to twine from left to right in ascending, different meanings will be found to be attached to this simple statement by different persons. But such indefiniteness would be intolerable, and a clear, precise rule has long been laid down, which if well understood will speedily decide every question of the kind. When an object rotates or revolves, its motion must be performed about some central axis, which remains for the moment relatively fixed. Suppose yourself to be this axis, and fix your attention on some particular point of the object. This point will, during some part of its course, pass over your breast; if, while doing so, it crosses from right to left, the rotation or revolution is said to be from right to left, and *vice versa*. The hop and the honeysuckle are said to twine from left to right; this means that if you suppose the plant coiled round your own body, the growing point will move from the left to the right hand, in passing over your breast. Similarly, the scarlet runner and the passion flower twine from right to left. The hands of a watch, placed face upwards, turn from left to right, as also does the sun in our hemisphere, but in the southern hemisphere he moves from right to left.—W. B. G.

White Varieties of Plants.—Perhaps Mr. Mott will be pleased to know of another locality for the white variety of *Prunella vulgaris*. I found it growing near the shores of Llyn Coron, (the habitat of *Elatine hexandra* and *Hydropiper*,) in Anglesea, where it was rather plentiful and very showy; it certainly appeared to be a well-marked variety. In Nant Francon occurred the white form of *Digitalis*. I have also gathered it near Birnam Hill, Perth. The rare white *Lamium purpureum* may be found in Northants, on the site of Rockingham Forest; and some young friends of mine brought me specimens from cultivated fields, near Hardingstone, in this county. Perhaps the most singular albino ever found was *Papaver Rhœas*, perfectly white, but in other respects similar to the type. On the borders of L.'Ancresse and the Grand Havre, Guernsey, the white form of *Erodium maritimum* was prevalent, almost to the exclusion of the ordinary form; and, as Prof. Babington pointed out in the Prim. Floræ *Sarnicæ*, the flesh-coloured variety *carnea*, of *anagallis arvensis*, is frequent on the Quenvais, Jersey, and L'Ancresse, Guernsey. I have gathered white *Campanula rotundifolia* at Aberglaslyn, at Harleston, Northants, &c., &c. *Erica cinerea*, white, at Kingsthorpe, Northants; *Calluna vulgaris*, white, at Harleston, Northants; and Conwyl in Carmarthenshire. One of the most lovely albinos I ever saw was *Menziesia polifolia*, which I gathered in Kylemore Pass, Connemara. *Geranium Robertianum*, var. alb., occurs in Northants, at Rothersthorpe; *Scabiosa columbaria* on the Downs, between Lewes and Brighton; *Carduus arvensis* and *acanthoides* in Northants, at Yardley Gobion; *Campanula latifolia*, white, at Troutbeck, Westmoreland. In concluding these scattered notes, I might just add that the locality for the white form of *Erodium maritimum* and *moschatum*, the sandy shores of the Grand Havre, and portion of the Braye du Valle, Guernsey, was also the habitat for the *Silene quinquevulvera*, which exhibited there its richest colours and most type-like appearance, and for the variety *modestum*, of *geranium Robertianum*.—G. C. Druce.

Gleanings.

Mosses.—We have Mr. Bagnall's second article "On the Study of the Mosses" in type, but are reluctantly compelled to withhold it till next month, in consequence of the illustrative plate not being quite ready.

Dr. Cobbold.—We have much pleasure in stating that at a general meeting of the Birmingham Natural History and Microscopical Society, held on the 30th ultimo, Dr. Cobbold, F.R.S., F.L.S., &c., was unanimously elected an Honorary Vice-President of the Society. The appointment was made on the recommendation of the Committee, pursuant to the provision of Law VIII., in consideration of Dr. Cobbold's distinguished researches in Natural Science and of his liberality to the Society. Dr. Darwin is the only Naturalist who has received a similar honour.

Autographic Printing.—In reference to the plates at the end of the May number of the "Midland Naturalist," it is necessary to state that they are not perfect specimens of Mr. Pumphrey's process. Owing to the necessity of printing a large number, lithography had to be employed as an auxiliary, as mentioned in the description, (p. 132,) and the delicacy of the lines was thereby completely destroyed. Besides that, some of the drawings were unsuitable, for the process has its faults, like most others, and it requires a little experience to produce the best results by it.

"The Old Cross" is the title of a new shilling quarterly magazine for Warwickshire and the neighbouring counties. The first number has just been issued, and is published by Messrs. Curtis and Beamish, Coventry. It is edited by Mr. W. G. Fretton, F.S.A. The contents are varied and interesting, the range of subjects being wide enough to suit the tastes of all classes of readers. There are several articles on Archæology, local Topography, and History; a capital one on "Sand and Sandstones," a biographical sketch of Mendelssohn, several good tales, some poetry, notes and queries, chess problems, &c. We warmly recommend "The Old Cross" to the attention of our readers.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—April 9th. Biological Section.—Mr. Blatch exhibited *Trichiosoma lucorum*, the large saw-fly of the hawthorn, and described the peculiarities of its metamorphoses, and its mode of extricating itself from the cocoon. Mr. J. Bagnall contributed and described microscopic preparations of the rare mosses, *Dicranella Schreberi*, Hedw., *Dicranella Grevilleana*, Br. and Sch., and *Trichostomum cylindricum*, Br. and Sch., and several other rare species; also, on behalf of Mr. Spinks, *Podura aquatica*, from the Lower Grounds, Aston. Mr. A. W. Wills then read a paper on "Freshwater Algæ," which will be found in the present number, being a continuation of one recently presented to the Society, and printed at page 113 of the "Midland Naturalist." The paper was illustrated by numerous specimens, living and mounted, which were shewn in the microscopes of the Society, and in those of various members who kindly lent their instruments for the evening. The thanks of the section were accorded to Mr. P. H. Gosse, F.R.S., for his kind present of a copy of his papers on *Bellidia Huntii* and *Hancockia eudactylota*, two supposed new genera and species.—April 30th. Special General Meeting.—It was resolved that a fund for increasing the apparatus and library be provided by a voluntary annual subscription amongst the members. The following exhibits were made:—By Mr. Bolton, spawn of a Mexican Lizard; by Mr. Slatter, spawn of the Perch *(Perca fluviatilis;)* and by Mr. Levick, *Stentor polymorphus* and *Cephalosiphon limnias*.—General Meeting, May 8th.—Exhibited by Mr. Southall, two leaves of *Calla Æthiopica*, with the petioles united; by Mr. Hughes, *Sepiola Rondeletii*, one of the smallest of the Cephalopoda; by Miss Hadley, a flower of *Primula Auricula*, with the calyx largely developed, the upper part being leaf-like, and the lower part coloured like the corolla; by Mr. Badger, specimens of *Aucuba Japonica* and *A. vera*, male and female, both in flower, female specimens with the flowers of the present year, and berries of the two preceding years. Mr. Lawson Tait read a paper on Cephalopoda, and illustrated it largely.

CHELTENHAM NATURAL SCIENCE SOCIETY.—March 21st, 1878.—Dr. T. Wright, M.D., F.R.S.E., President, in the chair.—F. Day, Esq, F.L.S., F.Z.S., &c., delivered an address on "Freshwater Fishes." He entered into the various questions—What is a Fish? How does it live, move, and continue its kind? Where do we find the first traces in the globe we inhabit? The importance of tracing out geological distribution; and, lastly, how fish have influenced human manners, customs, and commerce? By diagrams he explained the main divisions of the animal kingdom, and showed the several classifications that had been made from time to time, stating that the latest, dividing them into three, viz., Mammalia, Sauropsida, and Ichthyopsida, appeared to be the least objectionable. He gave a very interesting account of some recent experiments made with the *Salamandar* to prove that, though now it is normally born an air breather, it can be converted back again into what seems to have been its original form—one of the Amphibia having gills. He described the exterior skeleton of various fishes, their mode of progressing through the water by their fins, and how very strangely in some forms these become modified. He next took the scaleless forms, which he described. He then referred to the interior structure of fishes, noting the swim-bladder in its two distinct forms, both of which, by aid of specimens, he fully explained; then to the respiratory organs, giving the result of experiments that had been made to prove that some could not exist without air, particularly the Walking Fish, (Ophiocephalidæ,) and the length of time others could remain out of the water. He next reviewed the breeding of fishes. He exhibited some eggs taken from the mouth of male fishes. He referred to the fact that some species of frogs also carry the eggs in their mouths or pouches, not only until the young are hatched, but are old enough to take care of themselves; and as many as fifteen little tadpoles have been found in the pouch of the *Rhinoderma Darwinii*. He closed his remarks on this part by reference to the inter-breeding of fish, particularly amongst Carp and Herrings, and the difference that existed in such hybrids, adding that this fact deserved very attentive consideration, as new forms may be thus brought into existence, or that some of our genera do not deserve such a name, in fact may be but varieties, further remarking that if fishes of two genera can inter-breed, and the offspring is not barren, but can again inter-breed with one of the parents, he could scarcely imagine but that such a proceeding would rapidly efface the distinctive marks. He next took some of the senses, omitting hearing, sight, smell, and taste. He showed how fish have feelings and emotions, quoting observations of Dr. Cantor on the Fighting Fish of Siam, *(Macropodus pugnax,)* and the case of our own little Stickleback. He then referred to the geological features of his paper, and how there was a time when fish apparently did not exist. He showed that their distribution, and the appearance of the same species at distant places, were matters that would much interest the Geologist, and would tend to prove upheaval of parts of the Earth's crust. He concluded a very able and interesting paper by touching on the part fish may have played in early days in developing commerce, and furthering religious institutions particularly in India and Egypt, and how in later days it became a Christian emblem. Major Barnard, Rev. W. Symmonds, and others joined in the debate on the paper, to all of whom Mr. Day replied. The Rev. W. Symmonds also asked if the president would not give a paper on Fossil Fishes at some future day. This he agreed to do, and, after a cordial vote of thanks to Mr. F. Day for the paper, the proceedings terminated. April 18th.—Dr. T. Wright, M.D., F.R.S.E., in the chair. Auditors were re-elected, and F. D. Longe, Esq., F.G.S., read a paper on "The Relation of the Crust to the Interior of the Earth," a *resumé* of which will appear in a future number of the "Midland Naturalist."

DERBYSHIRE NATURALISTS' SOCIETY.—May 7th.—The Rev. W. H. Painter read a paper on "Fossil and Recent Cephalopoda." The species more frequently met with upon the coasts of England, the Cuttle-fish, *(Sepia officinalis,)* the Squid, *(Loligo vulgaris,)* and the Poulpe, *(Octopus vulgaris,)* having been alluded to, with their weapons of defence and offence, Mr. Painter described the arms and suckers of *Onychoteuthis Bartlingii* found in the West Indies, and compared them with those belonging to English species. The Cephalopods are divided by Prof. Owen into two orders, founded on the gills, *(branchiæ)*—Dibranchiata, and Tetrabranchiata, the latter of which comes first in geological time. Several genera were mentioned as occurring in the Cambrian Period, and specimens were exhibited of *Phragmoceras ventricosum*, *Orthoceras*

Ludense, *Lituites*, wherein they differed from each other being pointed out. The family of the Nautili was next traced, beginning with the *Nautili* of the Silurian, proceeding to the *Clymenia* of the Devonian, and the *Goniatites* of the Carboniferous, the differentia of each order being clearly shown. The family of the Ammonitidæ was dwelt upon at some length, the position of the siphuncle in the species being shown, and specimens exhibiting the foliaceous markings being produced. A specimen of the operculum of the Ammonite, from the lithographic stone of Solenhofen, was exhibited. Other genera, belonging to this family, were briefly touched upon, viz., the *Crioceras*, *Turrilites*, *Ancyloceras*, *Scaphites*, *Toxoceras*, *Hamites*, and *Baculites*. In treating of the Dibranchiata, the *Geoteuthis* of the Oxford clay, with its preserved ink bags, was mentioned; also, the *Ommastrephes*, represented by the recent *Ommastrephes sagittatus* of Newfoundland; the *Belemnites*, with their three component parts; the *Belemnitella*, the *Belemnoteuthis*, the Sepia, represented by *Sepia officinalis* of our coasts, the *Beloptera*, the *Belemnosis*, the *Spirulostra*, the *Argonaut*, the use of whose arms was fully explained, so exploding the pretty fable respecting them; and the *Spirula lævis* of New Zealand. This paper was illustrated by several choice specimens as well as by drawings.

DUDLEY AND MIDLAND GEOLOGICAL AND SCIENTIFIC SOCIETY AND FIELD CLUB.—The first Field Meeting of the season was held on Monday, April 29th, and included visits to the Netherton anticlinal, Hales Owen Church and Abbey, and the Leasowes. There were present Mr. Charles Cochrane (president) and about fifty other members, including many ladies. Assembling at Dudley Station, carriages were taken to Netherton Church, where the Rev. S. J. Marriot met the party. Walking down the hill to Brewen's Tunnel, over the canal, a fine section of the axis of the anticlinal was observed, which was well described in a paper read by Mr. G. Jones. Crossing the canal, Messrs. H. Doulton and Co.'s clay openwork was visited. Here a very fine section of the Coal-measures is exposed, and some good specimens of Coal-measure fossils were obtained. Re-crossing the canal, a walk was taken through the Saltwells Woods to the Saltwells Inn, where luncheon was provided. After examining the baths and mode of using the brine, the Rev. J. H. Thompson gave a short address as to the origin of the salt spring. Entering the carriages again, the way was taken to the outcrop of the Aymestry or Sedgley limestone at the Hayes, where Mr. Cochrane gave a short description of the fossils he had obtained there. Here also a very interesting, though now partially obscured, section of the Coal-measures was seen in the cutting of the Hayes branch of the Great Western Railway. From here the drive was continued to Hales Owen Church, where Archdeacon Hone met the party, and described the restorations that had taken place. After visiting (by permission of Mr. Green) the remains of the Abbey, a walk was taken (by permission of Mr. Gibbons) through the grounds of the Leasowes, after which the party returned to Dudley. A conversazione was held in the evening, at the Museum, by the invitation of the Dudley members, where a good selection of microscopes and other objects of interest were displayed.—On Tuesday, May 21st, the second Field Meeting took place, and was to Trysull, Pattingham, and the boulder district.

EVESHAM FIELD NATURALISTS' CLUB.—Meeting held Wednesday, May 1st, at the Evesham Institute, Mr. J. S. Slater in the chair. The first excursion of the club was fixed for Saturday, May 11th, to Ragley Park, and if that was impracticable to Mickleton. The following dates of the first appearance of some of the migratory birds were reported, almost all by Mr. A. H. Martin:—April 12th, Chiff-chaff, Wryneck; 15th, Sand Martin, Swallow; 16th, Nightingale; 19th, Whitethroat, Cuckoo, Sedgewarbler; 20th Sand-piper; 21st Goat-sucker, Swift; 25th, Nightjar; 30th, House Martin. Mr. Doeg produced some Blue-lias fossils from a brickyard, which had been given him by a workman there for the Club. Also a specimen of Testacella taken with several others in a piece of garden ground adjoining the town.

NOTTINGHAM LITERARY and PHILOSOPHICAL SOCIETY.—NATURAL SCIENCE SECTION.—May 8th.—MICROSCOPICAL MEETING.—A paper was read by Mr. J. Rogers, F.R.M.S., on "Mounting objects for the Microscope." May 22nd.—ANNUAL MEETING.

NOTTINGHAM NATURALISTS' SOCIETY.—April 17th.—A paper on the "The Teredo, or Shipworm," was read by Mr. B. S. Dodd. May 1st.—Lecture on "Australian Natural History," by Dr. Bancroft, formerly president of the society. May 15th.—"Fertilization of Plants," by Mr. C. L. Rothera, B.A.—Several afternoon excursions have been made during the month.

OSWESTRY AND WELSHPOOL NATURALISTS' FIELD CLUB AND ARCHÆOLOGICAL SOCIETY.—First Excursion for 1878 on Thursday, May 9th. A visit was paid to Selattyn, near which were found *Botrychium Lunaria*, *Havenaria bifolia*, and *Myrrhis odorata*. The route then lay along the line of Offa's Dyke, which is very plain here. A quarry of mountain limestone was also visited, where specimens of *Lithostrotion junceum* and *irregulare* were found, together with other mountain limestone fossils. The junction of the limestone with the millstone grit is shown near Carrybig, and from thence the party walked to the limestone quarries at Llawnt.

TAMWORTH NATURAL HISTORY, GEOLOGICAL, AND ANTIQUARIAN SOCIETY.—April 15th.—The Rev. Brooke Lambert, M.A., B.C.L., read a paper entitled "The Slough of Despond, and how to bridge it." An animated discussion ensued. May 6th.—A paper was read by Mr. Alfred Lucy on "Meteors and Meteorites," in which he pointed out that certain streams of these bodies occur periodically both on the same date, and coming from the same quarter of the heavens, owing to the earth's orbit crossing their tract. The high velocity of meteors protects us from the vast number which fall, by causing such friction with the atmosphere as not only to render them luminous but convert them into vapour by the intense heat. The connection between orbits of meteors and orbits of certain comets was shown and explained by Mr. Lucy, who also described the new theory of the origin of both meteor and comet streams. A discussion followed, and a hearty vote of thanks was awarded.—A rich collection of spring wild flowers was exhibited by Miss Harding.

WOOLHOPE NATURALISTS' FIELD CLUB.—April 23rd.—ANNUAL MEETING.—Mr. Theophilus Lane was appointed secretary in the place of the late Mr. A. Thompson. The President (Mr. J. Griffith Morris) delivered his retiring address. A large part of it was devoted to "Mycology," a subject to which the club has for many years devoted much attention. This portion of the address is so valuable and important that we shall in future numbers publish it in full.—The first Field Meeting of the year was held on Tuesday, May 28th. The members left Barr's Court Station at 9 40 A.M., to reach Ledbury at 10 23 A.M., where they were joined by members of the Malvern Club. They then proceeded to "The Wonder," where an address on "The Geological Features of the District" was given by the Rev. W. S. Symonds, M.A., F.G.S., &c.; and afterwards drove through Much Marcle, visiting Kempley Church, where some ancient "Mural Paintings" have been recently discovered; returning by Haffield to Ledbury. By Dr. Henry's kind permission, the members were allowed to visit the Camp at Haffield, and other objects of interest there.

WEST LONDON ENTOMOLOGICAL SOCIETY.—May 3rd.—HALF-YEARLY MEETING.—The following officers were elected for the ensuing six months:—President, Mr. Mapleson; vice-president, Mr. Smith; secretary, Mr. Timms, re-elected; curator, Mr. Silcock; treasurer, Mr. Dow, re-elected; librarian, Mr. Maycock, re-elected. On May 6th Mr. Meek took two specimens of that rare noctua, *X. conspicillaris*, at Darn Wood. On May 12th Mr. Russell took *N. trepida* at Highgate Wood.

EXCHANGE.

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

ANNUAL MEETING AT BIRMINGHAM.

The business of the First Annual Meeting of the Union commenced at Birmingham on Monday, May 27th. The Council met at twelve o'clock, and, having transacted the necessary preliminary business, adjourned to the Queen's Hotel, where, at half-past one o'clock, the President of the Union, Mr. Edmund Tonks, B.C.L., entertained them and the officers and past Presidents of the Birmingham Natural History and Microscopical Society, and some other of his Birmingham friends, at luncheon. At three o'clock the Annual Meeting of Members was held in the Lecture Theatre of the Birmingham and Midland Institute, the PRESIDENT in the chair. There was a large attendance, including Dr. Cobbold, F.R.S., (London,) Rev. W. H. Elliot, (Caradoc Field Club,) Rev. C. F. Thornewill, (Burton-upon-Trent Natural History and Archæological Society,) Rev. O. M. Feilden and Rev. G. G. Monck, (Oswestry and Welshpool Naturalists' Field Club,) Major Barnard, (Cheltenham Natural Science Society,) Mr. C. T. Musson and Mr. A. H. Simpson, (Nottingham Naturalists' Society,) Mr. I. Mosley, (Nottingham Literary and Philosophical Society,) Mr. E. B. Marten and Mr. E. Hollier, (Dudley, &c., Geological Society,) Mr. G. New and the Rev. J. C. Odgers, (Evesham Field Naturalists' Club,) Mr. T. Heath, (Derbyshire Naturalists' Society,) Rev. Dr. Deane, Rev. H. W. Crosskey; Messrs. W. R. Hughes, S. Allport, Sam. Timmins, T. Anderton, Lawson Tait, C. J. Woodward, W. G. Blatch, G. H. Twigg, W. H. Cox, C. E. B. Hewitt, and many others, including several ladies, and the Hon. Secs. to the Council, Mr. W. J. Harrison, (Leicester,) and Mr. Edward W. Badger, (Birmingham.)

The circular convening the meeting having been read, the PRESIDENT delivered the following

INAUGURAL ADDRESS.

As this is the first general meeting of the Associated Natural History, Philosophical, and Archæological Societies and Field Clubs of the Midland Counties, it is a matter of regret that the association at a period of its existence so critical has not as its President some member distinguished by his researches in Natural Science, and experienced in the organisation of scientific study, who might have guided its first steps in the right direction, and elaborated a scheme for its future action worthy of the occasion; whereas I, who am versed in no department of Science or Philosophy, and have only the accidental qualification for the office of being the President for the year of the Society, some of whose more active Members originated this Union, can only perform perfunctorily the duty devolved on me by my position.

Under these circumstances the time of the meeting will be more profitably expended in considering and discussing the best means of perfecting the organisation of the Society, than in listening to my crude remarks; it will therefore be my duty to make these remarks as brief

as possible, in order that they who have schemes for rendering available for a common object the scattered energies of the large body of earnest students in the several societies of the Union may have an opportunity of submitting them for consideration.

Such views as I have on the subject I will lay before you. The Union now consists of twenty-one Societies, and is, under its existing constitution, managed by a Council consisting of two Members from each of the Societies: that is, of forty-two members, with the prospect of increase. This managing body is far too large for efficient work, and I suggest that the present Council be converted into an electoral body, who shall appoint a committee for the general management of the affairs of the Union, consisting of say ten members, the Editors of the organ of the Union—the "Midland Naturalist"—to be members *ex officio.* I believe by this means more concentrated attention to the work would be secured, and a larger attendance at the meetings, for when each individual member of a large committee has to travel far, and sacrifice much time to attend a meeting, he will be but too ready to excuse himself on the ground that with so many others his presence will not be necessary; the inevitable consequence will be meetings rarely attended, and probably by different members on each occasion. It is of the utmost importance that a careful selection of men interested in the work be made in the first instance, and as far as possible the same men be present when the continuous work of the Union is transacted.

I earnestly recommend that the subscription to the general funds of the Union be reconsidered; it was fixed at the ludicrously insufficient sum of one penny per member;* if it be intended that any real joint work shall be done, and the organisation utilised as it may be, a larger though still moderate subscription is absolutely necessary, and may be profitably expended; it is premature to enter into details of this expenditure, but I may mention as an illustration of the necessity that the cost of the programme of the proceedings of this meeting would alone exhaust the whole revenue of the Union, and this is only one of many other items of legitimate expenditure for which provision ought to be made out of a common fund.

The pages of the "Midland Naturalist" form an excellent medium of intercommunication for the Members of the Union, and all of them, for their own and the general interest, ought to subscribe to it. This journal at present is the only offspring of the Union; although young, it is lusty and full of promise; it may be safely prophesied that as long as it succeeds, so long will the Union flourish; it is, in fact, our Palladium, our existence depends on its success. Such as can must render its pages interesting by contributions of the results of their observations in the various departments in Natural Science; all must help to secure its commercial success; we are bound in honour to do this, for as we have

*At the first meeting of the representatives of the several Societies then proposing to join the Union there was a division of opinion as to the subscription which would be necessary to carry out its objects, and it was only by a majority fixed at a penny per member, upon the representation that such sum had been found to be sufficient by the experience of the Yorkshire Naturalists' Union; since which date the Yorkshire Union has, in a circular addressed to its members, (printed in this number,) called attention to the obvious inadequateness of this subscription to defray the necessary expenses.

been relieved of the risk of its publication by the liberal action of the Proprietors of the *Midland Counties Herald*, no indifference on our part must leave loss to fall upon them; a subscription is no mere contribution towards the common weal, full value is returned for it. Under the excellent editorship of Mr. E. W. Badger and Mr. W. J. Harrison, the journal has been so conducted that, if the progress exhibited in the first five numbers continues, it will speedily acquire more than a local fame, and the United Societies, when it is established on a firm basis, may with legitimate pride point to the "Midland Naturalist" as the first work of, and a sufficient reason for, their Union.

But we have other duties besides those which tend to secure the success of our local organisation; we are British as well as Midland Naturalists, and ought by all means in our power to aid in extending the usefulness of those representative Societies of our country, of world-wide reputation, whose reports, transactions, and other publications, form in a great part the basis of the knowledge we possess of the various subjects of our studies; probably many of you consult these reports and transactions for the valuable information they contain, well contented if your local library possesses them, without giving a thought to the cost of their production. But, however distinguished may be these Societies, they are maintained by the subscriptions of their members, and their publications are limited, and consequently their utility, by the measure of their funds; many precious treatises, the results of the long observation, and earnest thought of some of our best observers of Nature, are, for lack of the means of publication, lost to science, and the energies of succeeding Naturalists have to be wasted in going over the same ground again, which might have been more profitably expended in working out new discoveries. It is the duty of every true Naturalist, who can afford the few guineas necessary to constitute membership, to join these Societies, and aid the general cause of science by increasing their means of utility.

The Societies to which I especially refer are:—The Linnean Society, which was founded in 1788 for the cultivation of Natural History in all its branches, and more especially the Natural History of Great Britain and Ireland.

The Geological Society of London, instituted in 1807, for the investigation of the Mineral Structure of the earth.

The Zoological Society of London, instituted in 1826, for the advancement of Zoology, and the introduction and exhibition of subjects of the animal kingdom alive, and in a state of preservation.

The Entomological Society, founded in 1833, for the cultivation of the knowledge of the structure, uses, habits, and functions of the Insect tribes, both native and foreign.

The Ray Society, founded in 1844, for printing such works in Natural History as stand in need of extraneous assistance to secure their publication.

And the Palæontographical Society, established in 1847, for the purpose of figuring and describing the whole of the British Fossils.

The last two Societies are specially deserving of the support both of the several societies in the Union, and of the individual members; the

subscription to them is extremely moderate, one guinea per annum; and, as they are purely publishing societies, and do not hold periodical meetings for the reading of papers and discussion, the subscriber in the country has the full benefit of their operations. Generally one or more elaborately illustrated monographs are issued by each Society every year, exceeding in cost the amount of the subscriptions, as these have frequently been supplemented by considerable pecuniary assistance from the learned authors, who also devote their time and knowledge to the preparation of the works gratuitously.

It appears to me that the individual members, or associations of them, of an organisation like this, who are scattered over a wide area, varying in its flora, fauna, and geological conditions, might turn to profitable account the peculiar opportunities afforded by their several districts in determining many unsettled problems in Natural History. What these problems are I must leave to the decision of such of you as are skilled in the various branches of science; but I will venture to suggest one as an illustration of the kind to which I refer: What is that which determines the sexes of Bees? Is the sex an inherent quality of the egg, or is it modified in the development of the larva by circumstances? Bees, always excepting their stings, afford very favourable opportunities of studying this question; and the knowledge we already possess of some of the peculiarities of the development of the one sex may help us in that of the other. Schirach, and afterwards Huber, taught us that the working bee is an imperfectly developed female, and to make the perfect female from the egg, which, deposited in a worker's cell, would have produced a working bee, nothing more is necessary than sufficient room for its development, and special food during its growth from a certain stage. It appears a natural question to ask, if a modification of this kind will change a neuter into a perfect female bee, will a modification of another kind, that is, the peculiar size of the drone cell, and some unsolved treatment in nutrition, cause the egg to become a drone, which, deposited elsewhere, and treated otherwise, would have become a worker or a queen? It does not seem unreasonable to suppose that the determination of sex is only a question of room and nutriment, when we not only find these influences have such an effect in the arrested and perfected development of the female in bees, but we know that in mammals there is a period in the fœtal growth when the sex is not determined, and the fœtus may be called bisexual; and it is only at a further stage that the growth of the organ of the one sex is arrested, and that of the other developed.

Possibly this problem has been solved, but in my limited reading on the subject I have not met with its solution; however, solved or not, it will serve my purpose of suggesting a class of problems upon which the united power of the organisation may be usefully employed. As difficulties occur in the course of the investigations of individual members, they should be by them brought under the notice of the members of the Union generally, by publication in the "Midland Naturalist," when the investigations can be taken up by such as have the special opportunities of observation requisite, with the probable result of a satisfactory solution in many cases.

A wide field of investigation is open to the patient Naturalist who will devote his energies to the study of that strange class of organisms, the parasites of man. Dr. Spencer Cobbold, the most eminent of British Helminthologists, who has recently honoured our local society by accepting the office of honorary vice-president, is now engaged in publishing, in the "Midland Naturalist," a series of papers in which he brings before our notice the fact, that the complete life-history of many of these human plagues is yet untraced. Here is full and useful occupation for such of you as have the necessary patience and application. The full career of some of them has been clearly demonstrated, through a series of metamorphoses more strange and bewildering than any we have read of in the fabulous pages of Eastern tale; wonderful as are the records of the Thousand-and-One Nights, no story related by Sheherazade is so full of marvel as that of the varying phases of the life-career of a simple cestode worm. In unravelling the thread of such a career, and distinctly tracing it through all its changes, you may by some happy discovery of the peculiarities of one or other of these formidable guests, gain the proud distinction of having conferred a benefit on mankind. At present we know what fatal mischief they work upon their hosts; but our knowledge is not sufficient to enable us to guard effectually against their unwelcome visits. It must be that, in a union of so many desirous of penetrating the secrets of nature, some by education and tastes are eminently qualified for this difficult pursuit. Its utility ought to be a sufficient inducement to follow it, and the absorbing interest it would generate in its followers would be their sufficient reward.

This special field of observation is not limited, as to its objects, to the ordinary entozoa and epizoa, which hitherto have been included in the lists of the Helminthologist; most of these are distinctly visible without the assistance of the microscope, which is only required for the examination of the details of their structure; there is evidence of the existence of a large class of organisms, whose interference with our vital economy is far more fatal than that of ordinary parasites; these are so minute as to tax the skill of the most expert histologists, and require the most perfect instruments to detect their existence. The generally accepted theory of their action appears to explain satisfactorily the course of many fatal diseases, as scarlet and other fevers, measles, small-pox, and, in fact, most of the diseases attributed to contagion; but much more evidence is required to establish the theory on a firm basis. Already a large body of acute observers throughout the scientific world are engaged in pursuing this study; and the evidence obtained with reference to one particular form of disease—splenic or relapsing fever—appears to be conclusive, as numerous specimens of a peculiar form of Bacteria, called Spirilla, are always found to be present in the blood of persons while suffering from this fever, which disappear during the intermissions, and when the fever passes away. Other forms of Bacteria have been detected in the blood in other diseases; but much evidence is still required to distinguish and identify them as the several causes of the mischief in the varying forms of contagion, the search for which will

afford a worthy occupation for the best Histologists and Physiologists amongst you.

It would be presumption on my part to attempt to teach Geologists their duty, but, subject to their correction, I suggest they might utilise their local knowledge in checking, and rectifying where necessary, the accepted geological map of the district; howevei correct it may be in its general arrangement, doubtless many details may be added to it which would materially increase its value. If the idea be thought worthy of adoption, the geologists of the Union may easily organise their labour so as to obtain the best effects from it, the district may be subdivided into sections, in each of which a sub-committee, bringing to bear its united local knowledge, could carry the work into effect with a completeness scarcely attainable in other ways. If the attempt should prove successful probably other districts would follow the example, and ultimately, through our initiation, the country might possess a general geological map, with an abundance and an accuracy of detail, such as could only be produced by the well-ordered work of an army of enthusiasts.

Our midland district is rich in the objects of the study of the Botanist and Zoologist; their branches of natural science are within the reach of every one, and the favourite pursuits of many. Of the almost infinite variety of vegetable and animal life, afforded by this fair field, much is unrecorded; aid in supplying this deficiency. Many great undertakings, which would be a tax too severe upon the individual member, burdened with the absorbing cares of his own vocation and family, may be successfully accomplished by division of labour, and the work devoted to their execution would be converted into recreation when subdivided and carried out in association with friends of congenial tastes, all equally eager to advance the progress of science.

A system of interchange of specimens should be arranged, to supply from the superabundance of one district the deficiencies of another. This might be effected by an exchange column in the "Midland Naturalist;" and I recommend that, when an object of singular interest has been exhibited at a meeting of any society, the fact should be published in the same medium, and, so far as possible, on application by the secretaries of other societies, the loan of the object should be granted for exhibition throughout the Union; and further, it may be desirable on special occasions to extend the principle to papers of exceptional interest. By such and similar means the interest of meetings may be largely extended, more especially to the advantage of the smaller societies, and the districts with fewest natural advantages.

The Union, if it contain a proportion of enthusiastic Naturalists equal to that of the Birmingham Society, as doubtless it does, will afford the means of organising extended marine excursions, such as to the coast of Ireland, the Mediterranean, or elsewhere, in search of new fields of observation in marine zoology, geology, and other branches of natural science, and realise the day dream of our distinguished marine zoologist, Mr. W. R. Hughes. As this class of excursion involves the necessity of chartering a steam yacht of capacity sufficient for open sea work, and

consequently a large total expenditure, a single society rarely contains a number of members having the leisure and means sufficient to form a company which will subdivide the expenses so as to reduce them to a reasonable amount per head; but in the larger association the necessary number ought to be easily found. Such excursions, independently of the direct results which may be expected from the opportunities they afford for investigations of new sources of knowledge, would have the inestimable advantage of intimately associating for a lengthened period the best Naturalists of the district, whereby many valuable friendships may be formed, and thence some indirect benefits to science be expected to accrue. I can speak with the more confidence on the subject, as I have enjoyed and witnessed the results of our own less extended excursions to such places as Teignmouth and Arran. I have heard the many expressions of satisfaction at the pleasure derived from the opportunities of friendly intercourse of members who previously were comparative strangers to one another, and noted with satisfaction the increase of practical knowledge gained of subjects, which before had been confined to the comparatively imperfect information to be derived from books. For the latter class of excursions association of the societies generally is not necessary, or even desirable, for the numbers of the members of the Union who would be willing to form a party to visit a place of such surpassing interest as Arran, where the botanist, zoologist, or geologist can revel in the superabundance of objects of his special pursuit, would become unmanageable, as the means of accommodation in such places, although often very good, are but small; however, it may be convenient for two or more of the smaller societies to associate for these excursions; probably the best number for the purpose is twenty, and the best destination, if not previously visited, and even then so many fresh objects might not be found elsewhere, is Arran.

I have to the best of my ability endeavoured to show what may be usefully done by the Union. I have one suggestion to make to the individual members of the several societies. The Union is, speaking generally, strong in proportion to the number of societies of which it is composed; the societies in proportion to the number of their members. It is, therefore, the obvious duty of every member to induce his friends to join his society; he may meet with the objection on the part of his friends that they are not Naturalists; he must urge in reply that, although working Naturalists are few, all are interested in natural phenomena, and all can, by subscribing to its funds, assist a society which is working much good in cultivating intellectual pursuits and disseminating valuable knowledge. It is without doubt true that many are deterred from entering on the most engrossing and enchanting pursuit, which has even banished *ennui* and melancholy from its happy followers, by the mistaken idea that no progress can be made in it without painful application to the study of the technical details of the refined distinctions, which are supposed to be the boundary marks between one and another species or variety, and of the too often unmeaning and barbarous names violating all rules of grammar and

language, with which it has delighted many closet Naturalists to favour in such liberal profusion each individual in the organic and inorganic world as to render identification sometimes impossible ; but knowledge of this kind is not requisite to constitute a Naturalist.

He who notes with intelligence the ever-varying phases of nature is a Naturalist. That title could not have been denied to Thomas Edward, whose charming biography by Smiles you all have, or ought to have read, before he had acquired in the later part of his life the art of classification; and he is not a perfect Naturalist who limits himself to the technical details of the science, but he who extends his observations to the habits, cultivation, use, and relation to the surrounding universe of every object of his scientific pursuit, may rightly claim that title.

I hope it will not be supposed that I depreciate in any way the value of the exact study of the technical details of a science; I merely protest against that view which would limit science to an index; books are comparatively useless without an index, but an index is absolutely so without the contents to which it refers; many scientists never get beyond the index; in fact, they often appear to take pains to avoid giving details of general interest for fear their writings, by becoming intelligible and popular, should be damaged in their scientific character. Our forefathers did not arrange their plants under a system of classification so perfect as ours; but they knew much more of the plants themselves, and if the eclectic physician in the present day wishes to learn something of their properties, he does not consult a modern treatise but has recourse to a black letter herbal.

Accurate knowledge of technical details is necessary as a foundation for the structure of the larger and more valuable knowledge of nature itself, and the acquisition of that technical knowledge brings with it other rewards; for the mental training, which results from the sustained exercise of the faculties upon a subject which requires so much application and precision, eminently qualifies the student for the business of life.

I hope some of the energies of the Union will be devoted to the repression of those pirates sailing under false colours, *soi-disant* Naturalists, who, preying on nature, hunt after every rare and beautiful plant, or bird, or animal to destroy it, nominally on the pretence of obtaining specimens, which in many cases are not preserved, and even when preserved are useless for the advancement of science, whose real object is to gratify that passion for destruction unfortunately common to many, and a morbid craving for notoriety, to which numerous journals pander by publishing the disgraceful fact, as if it were a subject of interest and congratulation for the world to know that a beautiful living object and all its possible offspring had perished for ever; I sincerely hope our "Midland Naturalist" will not soil its pages with any such records. The ultimate destruction of many of the most interesting of our *feræ naturæ* in a country where population, buildings, and cultivation are rapidly extending, is inevitable, and only a question of time, but still much may be done to prolong their stay with us, and the Naturalist ought

to be their protector. Charles Waterton, the very type of the real Naturalist, proved at Walton Hall how much might be done by non-interference. The Park, under his care, was soon filled with birds and animals, who were attracted not by feeding and other artificial contrivances, but by its peaceful retreats, where they soon acquired the knowledge that they might abide there undisturbed; no gamekeeper was employed, nor was any gun or trap used for the purpose of keeping down vermin; birds and beasts of prey had full liberty to range through those real preserves, where nature alone determined the balance; the result was, with no dearth of game, both great and small, a greater variety of other living creatures congregated on a limited area than can now be found in extended districts. There the Naturalist might study the habits of the various tribes which make the country beautiful, with an ease afforded in few other resorts, for freedom from interference had made them fearless and tame; elsewhere, with good reason, they dread the sight of man, and so far as is possible keep themselves out of his range. We cannot turn the whole country into a preserve like this; the necessities of a teeming population must take precedence; but there will be yet for a long time many nooks and corners which will be frequented by the varied objects of our study, if we leave them alone, and content ourselves to—

Look on this beautiful world, and read the truth
In her fair page; see, every season brings
New change to her, of everlasting youth;
Still, the green soil with joyous living things
Swarms, the wide air is full of joyous wings,
And myriads still are happy in the sleep
Of ocean's azure gulfs.

Dr. Spencer Cobbold, F.R.S., then addressed the meeting. He said he had listened to many addresses in years past, but he had never listened to one affording more pleasure, and more instruction and satisfaction, than that delivered by their President. He congratulated the President on his address, inasmuch as he had left no stone unturned in marking the course the Union should take. The range of the address they had just heard was very extensive. With whomsoever the idea of the Union of Midland Natural History Societies originated, he (Dr. Cobbold) must say that the thought was a most happy one; he had no doubt that the origin in the first instance might be traced to the British Association for the Advancement of Science. Now the British Association had no doubt done much good work, but still its name was, to some extent, a misnomer. The British Association should be called "The British Association for the Diffusion of Science." It had done its work well, inasmuch as it had set going many persons, in places where it had established what he might call a temporary home, and perhaps in no town had its effects been more felt than in the town of Birmingham. He thought the union of the Natural History Societies of the Midlands would really prove a greater vehicle for the advancement of science than the projectors of the Union ever dreamt of, inasmuch as members would no doubt adopt what was insisted upon in the President's paper, and become actual workers in the cause of science. There was another object which he had no doubt would be achieved by the Union, namely the encouragement of native talent. Men who had hitherto not had the opportunities would endeavour to make them, and being encouraged by those around

them would really begin work in some department of Natural History, and keep to it. These men when once interested would be untiring students. He concluded an admirable speech by proposing a vote of thanks to the President for his address.

Major BARNARD seconded the motion. The part of the address which elicited his warmest sympathies was that in which the President spoke of the duties of Naturalists and how they should endeavour to spread the knowledge of Natural History in general. He was of opinion that the Midland Union of Naturalists would become, in a few years, a Society of considerable influence in the country at large. He hoped one object would be kept in view by the members of the Union,—namely, that of promoting the study of Natural History in our schools. No doubt a great many efforts were being made in that direction at the present time, but still a little gentle pressure would, he was sure, be productive of good. It was true that a great many schools professed to teach Natural Science, but when they came to look into the matter they found, somehow or other, that the teaching of Natural History occupied only a very small corner. Indeed, he had found, from enquiries he had made, that one lesson a week was the maximum. He thought, therefore, it might be a legitimate thing for the members to do, and he felt assured so large a number of members, with such an amount of influence as they possessed, would, if they brought that influence to bear, be able to achieve great results in that direction.

The motion was put and carried unanimously, and briefly acknowledged by the CHAIRMAN.

The report of the Council was then read by Mr. W. J. HARRISON.

After detailing the history of the formation of the Union, (see pages 1 to 4 "Midland Naturalist,") it went on to speak of the journal of the Union—the "Midland Naturalist"—and expressed the opinion that it had already fully realised the expectations of the Council, and urged all members who are not at present subscribers to become so at once. The report then proceeded as follows:—

"The Societies constituting the Union are—

The Birmingham Natural History and Microscopical Society.
The Birmingham Philosophical Society.
The Birmingham and Midland Institute Scientific Society.
The Birmingham School Natural History Society.
The Burton-on-Trent Natural History and Archæological Society.
The Caradoc Field Club.
The Cheltenham Natural Science Society.
The Derbyshire Naturalists' Society.
The Dudley and Midland Geological and Scientific Society and Field Club.
The Evesham Field Naturalists' Club.
The Leicester Literary and Philosophical Society.
The Northampton Naturalists' Society.
The Nottingham Literary and Philosophical Society.
The Nottingham Naturalists' Society.
The Rugby School Natural History Society.
The Oswestry and Welshpool Naturalists' Field Club.
The Severn Valley Naturalists' Field Club.
The Shropshire Archæological and Natural History Society.
The Stroud Natural History and Philosophical Society.
The Tamworth Natural History, Geological, and Antiquarian Society, and
The Woolhope Naturalists' Field Club.

"Your Council hope other local Societies will join the Union, and have reason to think that several contemplate doing so.*

"The objects of the Union may be broadly stated to be to extend the usefulness of Local Societies by affording facilities for inter-communication through an authorised and regularly published magazine, which records the more important work done by them; announces their forthcoming meetings and excursions; and assist in the interchange of notes and specimens; and, by providing opportunities for personal intercourse among the members at meetings to be held from time to time in various places of interest, and in other ways, to promote the study of Natural History, and other scientific subjects.

"Your Council desire to record their warm appreciation of the hearty efforts which the Birmingham and Dudley Societies have made to ensure the first meeting of the Union being successful and interesting. The Conversazione which will take place in the Town Hall this evening will give members of distant societies some idea of the scientific and other resources of local members and will afford an excellent opportunity for social and intellectual intercourse. The excursion to Dudley and neighbourhood to-morrow will supply an admirable opportunity for the study of some of the geological features of a most interesting and important district, while the archæological members will find much to occupy their attention. Your Council feel that the thanks of the members are due and are assured that they will be warmly tendered to the gentlemen who have with admirable foresight, much labour, and expense made these arrangements for their edification and instruction.

"Your Council recommend that they be empowered to appoint a small Committee of Management to transact the general business of the Union. They also submit bye-laws for your consideration.

"The present subscription of one penny per member is deemed by your Council as quite inadequate to enable the Union to engage in any real work, and they desire to have your opinion as to whether it should not be increased, and if so to what amount.

"It now only remains for your Council to state that it recommends this meeting to select Leicester for the next annual gathering of the Union, and to express the hope that this association of societies may be increasingly instrumental in fostering the study of Natural History and allied sciences."

The PRESIDENT moved the adoption of the report. He strongly recommended the meeting to adopt the suggestion of the Council, and empower them to select as a Committee of Management ten members of the Council and the editors of the "Midland Naturalist," *ex officio*. As to the amount subscribed by each member annually he for his part could not think what induced the promoters of the Union to fix the sum so low. The subscription would only pay the postage of two circulars to each of the members. He recommended the meeting to pass some resolution fixing the subscription at a reasonable amount. His own idea was one shilling per annum per member if the societies of the Union meant to do real work.

The motion was seconded by the Rev. W. H. ELLIOT, and carried.

The PRESIDENT then moved that the Council be empowered to appoint a Sub-committee of Management to conduct the business of the Union.

Mr. LAWSON TAIT seconded the motion, which was carried.

* "The Peterborough Natural History and Scientific Society" has since joined the Union.

The PRESIDENT next moved, that it be a recommendation of this meeting to each individual Society, that the subscription to the Union be raised to one shilling. He said he was unable to say what work the Yorkshire Union had done, when its members only contributed a subscription of one penny per annum. Such a subscription appeared to him to be ridiculously small and inadequate.*

The motion was not seconded; but an animated discussion ensued, in which Mr. C. J. WOODWARD, Mr. LAWSON TAIT, the Rev. C. F. THORNEWILL, Mr. G. H. TWIGG, the Rev. W. H. ELLIOT, Mr. E. HOLLIER, and others took part. It was ultimately resolved on the motion of the PRESIDENT, seconded by Mr. G. H. TWIGG, "That it be a recommendation from this meeting that the annual subscription be raised, and that honorary secretaries be requested to report to a future meeting of the Union the opinion of their societies upon the subject."

The Treasurer's report was then read by Mr. EDWARD W. BADGER, (in the unavoidable absence of Mr. E. D. Hamel.) It showed that the total receipts for the year, contributed by twenty-one societies, consisting of 2,683 members, were £11. 4s. 10d. The report was adopted.

Mr. LAWSON TAIT read the following

BYE-LAWS.

1.—That the Annual Meeting of the Midland Union of Natural History Societies shall be held, from time to time, in the towns in which the various Societies of the Union are located; that the President of the Society in connection with which the Annual Meeting shall be held, shall be the President of the Union for the year, and, *ex officio*, a member of the Council; and that where more than one Society in the same town is in the Union, the question of the Presidency shall be determined by those Societies.

2.—That the Annual Meetings of the Union shall be held in May, and that all the arrangements for the same shall be made by the Society or Societies of the town in which it is to be held.

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* This is a subject of so much importance, that we gladly print a circular which the Yorkshire Naturalists' Union have issued on the work to be done, and the necessity for an increased subscription:—

"THE YORKSHIRE NATURALISTS' UNION.—The Secretaries have been directed by the Council to call your attention to the desirability of a sufficient income being at once raised to enable the Union to commence the publication of reports and papers upon the Natural History of the county, as well as to defray the necessary expenses connected with the meetings.

"It is intended to issue the following papers, &c., which are now in preparation, as soon as the requisite funds have been raised—

"1. A history of the West Riding Consolidated Naturalists' Society, from 1861 to 1876 inclusive.

"2. A map of Yorkshire, showing the districts, based upon the river-drainage system, into which the county will be divided, for the purpose of investigating the fauna and flora. This map will be accompanied by an explanatory paper, describing in words the boundaries of the various districts.

"3. The reports and proceedings of the Union and of its Sections, together with such papers and catalogues as may be considered of sufficient value by the Council.

"It is perfectly obvious that the contributions paid by the affiliated Societies, of 1d. per member per annum, are quite inadequate for this purpose, and you will see that the total income required, more especially for the *first year*, when the map is to be published, is very considerable. The Council consequently have confidence in inviting you to contribute to the extent of your ability and inclination; and while large amounts are sought from all those who are able to give them, *they wish it to be understood* that small amounts are likewise acceptable. Among the sums already given are such amounts as Two Shillings, Half-a-Crown, Five Shillings, Half-a-Guinea, One Guinea, and Two Guineas. Subscribers of 2s. 6d. and upwards will be entitled to receive the publications of the Union.

"The Council trust that the response to this appeal may be such as to justify them in ordering the early publication of the map and reports."—[EDS. M. N.]

3.—That the Secretaries of the Council, and any other two members of the Council may summon a Special Meeting of the Council, and that the Secretaries shall summon a Special Meeting of the Council on the requisition of any five members.

4.—That the Council shall hold an Ordinary Meeting at the commencement of and another at the conclusion of the Annual Meeting of the Union.

5.—That the Secretaries and Treasurer shall present reports at the first of these meetings.

6.—That the time and place of the next Annual Meeting shall be decided by the Council at the first of their ordinary meetings.

7.—That the President of the Union shall be for the time the President of the Council; and that there shall be two Secretaries and a Treasurer elected annually.

The Bye-laws were adopted.

Mr. Edward W. Badger and Mr. W. J. Harrison were re-elected Honorary Secretaries, and Mr. Egbert D. Hamel Honorary Treasurer.

On the motion of the President, seconded by Mr. W. R. Hughes, it was resolved that the next annual meeting of the Union be held at Leicester.

The President having stated that a suggestion had been made that a joint excursion should be made to Castleton, next invited remarks from any of the members who desired to point out how the Union might be rendered most useful.

Mr. Harrison said it seemed to him the best thing to do was to place before themselves several definite objects. The only branch of science in which he was specially interested was that of Geology, and on that subject those members who took an interest in it, although they lived apart, could co-operate with each other. The subject of the glacial deposits was one which he thought might most advantageously be considered by the members of the Union. He moved the following resolution:—"That the subject of the glacial drift-deposits be referred to the Council as one well adapted for conjoint observation by the Societies in the Union."

Mr. Tait having seconded the motion, it was carried.

The Rev. C. F. Thornewill said he felt they ought not to separate without passing a hearty vote of thanks to the Birmingham and Dudley Societies for the excellent arrangements they had made for the instruction and enjoyment of members. It had been said that he was a bold man who first ate an oyster, and certainly it was a bold step to take to start the Union, and also to bring members together for a couple of days enjoyment and instruction.

Major Barnard seconded the motion, which was unanimously carried.

A vote of thanks to the President for his courteous conduct in the chair terminated the proceedings.

THE CONVERSAZIONE.

When it became known that the Midland Union of Natural History Societies would hold its First Annual Meeting at Birmingham, the local societies set vigorously to work to provide a hearty welcome for their visitors. The result was a most enjoyable conversazione, which was held in the Town Hall, on Monday evening, May 27, from 7 30 to 10 30, and attracted 700 visitors. Though we hope to afford some idea of the nature and variety of the exhibits brought together on that occasion,

they were so numerous as to preclude the attempt to do more than briefly mention the more important items.

The Microscopical display was unusually large and interesting. There were some seventy microscopes in use, including some kindly lent by Mr. T. W. Watson, Mr. E. Wheeler, and Mr. F. Enock, of London, and they were so excellently disposed at such convenient distances that all were easily accessible by the many visitors. Commencing with the living objects illustrating Pond Life we have to enumerate the following:—Freshwater Polyzoa—Alcyonella fungosa, Fredericella sultana, and Paludicella Ehrenbergii; Melicerta ringens, (the building rotifer,) and Epistylis natans, exhibited by Mr. Thos. Bolton; Lophopus crystallinus, by Rev. Dr. Deane; Conochilus volvox, and Actinosphærium sol, by Mr. T. J. Slatter; Hydatina senta, one of the largest of the British rotifers, by Mr. H. E. Forrest; and Hydra vulgaris and Hydra viridis, showing the reproduction by budding, by Mr. J. Levick.—Then there were among many mounted objects Anguinaria spatulata, (Snake's head Coralline,) and section of Pearl, exhibited by Mr. W. H. Pearson; Plumularia setacea, with tentacles expanded, Membranipora pilosa, and Alcyonidium hirsutum, with tentacles expanded, by Mr. A. W. Wills; larval forms of Crab, and Sertularia with tentacles expanded, by Mr. W. Graham; Star-fishes and Sea-urchins, (illustrations of structure,) young Oysters, and Entozoa, illustrating the Trematoda, Cestoda, and Nematoda, by Mr. W. R. Hughes; spines of Echinus, by Rev. Dr. Deane; Dog's Tongue,—section showing the glands and villi, Dog's Foot-pad,—section showing arterial vascularity, and Human Intestine,—section showing villi injected, by Mr. F. W. Spiller; Palate of Cuttle-fish, by Mr. C. Pumphrey. Mr. F. Enock, of London, (an old member of the Birmingham Natural History Society,) showed a number of insects, mounted whole, without pressure, by an entirely new process, which has taken Mr. Enock some years to bring to perfection. These insects retain all their natural form; some show their internal muscular structure; in these can be seen every minute muscle, and the purpose for which it is intended can be clearly traced out; others, such as tongues of various insects, are prepared so as to retain all the natural form, colour, and characteristic markings without any distortion whatever, thus rendering the preparations of the utmost value to the student. We may specially mention Stylops Spencii, parasite of the wild Bee; Polynema ovulorum, the Fairy fly, (its larva is born and matured within the egg of the Cabbage butterfly;) Atypus Sulzeri, English trap-door spider. Stylops Spencii, in the act of emerging from body of wild bee, was also exhibited by Mr. J. Potts. Mr. Edmund Tonks exhibited Spinnerets of Spider. Mr. E. Wheeler, of London, exhibited 1,000 microscopic objects, (no two alike,) representing every department of microscopy. His elaborate groups of Diatoms, Foraminifera from "Challenger" dredgings, Polariscope objects, Möller's Typen-platten, Webb's Micro-engravings, anatomical specimens, opaque objects Geological objects, and the Colorado Beetle, proved most attractive.

We come now to illustrations of Vegetable Life. Of Freshwater Algæ there were Spirogyra nitida, Mesocarpus scalaris, Zygnema lutescens, and Staurocarpus gracilis, showing formation of spores by conjugation; Batrachospermum alpestre and vagum, and Draparnaldia plumosa, all exhibited by Mr. A. W. Wills; Volvox globator, (living specimens showing the rotation,) by Mr. Levick and Dr. W. Hinds; spores of Equisetum, showing the contraction of elastic filaments by moisture and their expansion on drying, by Mr. W. B. Grove. Protonema of moss, showing germination of spore; section of Mnium subglobosum, showing male and female flowers of moss; Peristomes of mosses; sections of leaves of holly, grass, and fern;

capsules and perichætial leaves of moss, Cryphæe heteromalla, by Mr. J. E. Bagnall. Sections of stems and leaves of plants, differentially stained to show the structure, by Mr. W. Teasdale. Section of potato, with starch grains in situ, polarised; compound spiral vessels from rhubarb, polarised; group of fern scales, Nothochlæna lævis, polarised, by Dr. Deane; and Chara, showing the spurious circulation, by Mr. T. J. Slatter. Mr. J. E. Bagnall contributed a complete collection of the grasses and sedges of Warwickshire, (dried specimens;) Dr. W. Hinds a collection of the British poisonous plants, (dried specimens;) Mr. J. Morley a collection of nearly all the species of British ferns, (living plants;) and Mr. E. Wheeler a most instructive series of microscopical preparations, illustrating the histology and reproduction of plants.

The Conchological display made by Mr. G. Sherriff Tye was of marked interest, and consisted of part of his collection of British Shells, which numbers many thousand specimens. The series included fine selected examples of nearly all the land and freshwater shells hitherto found in the neighbourhood of Birmingham, viz., about eighty species and fifty varieties; also many very local and some rare shells. Among the former may be mentioned Sphærium corneum, *var.* flavescens; S. lacustre, *var.* Ryckholtii; Anodonta cygnea, *var.* pallida; A. anatina, *var.* complanata; Planorbis lineatus; P. dilatatus; Limnæa peregra, *var.* lacustris; L. peregra, *var.* maritima, &c., &c. Among the rare shells were albinos of the following species:—Anodonta anatina, Bythinia tentaculata, Limnæa peregra, L. palustris, L. trunculata, Helix sericea, H. virgata, H. Pisana, Pupa secale, Clansilia rugosa, and others. The rare Vertigo Moulinsiana, Helix obvoluta, Succinea oblonga, Limnæa glutinosa, and Limnæa involuta were noticeable species. We might specify many rare or uncommon forms in the marine portion, but want of space forbids it; we will only add that the collection was characterised by neatness and clearness of arrangement, and is the result of years of labour. Dr. Schwarz also exhibited shells from Celebes and Ceylon. Mr. W. H. Pearson exhibited Japanese and Chinese Silk-worm Moths with Cocoons; while cases of insects collected in Brazil, comprising moths, butterflies, and beetles, showing the brilliant colouring characteristic of tropical insects, were exhibited by Mr. S. Allport.

The Geological exhibits were very numerous and interesting. There were sections showing junction of Igneous and Sedimentary Rock, and section from Bone Bed of Rhætic age in South Wales, exhibited by Dr. Deane; Pitchstone from Arran showing plumose crystals arranged in lines forming contorted weather markings, by Mr. C. Pumphrey; sections of Volcanic Rocks, illustrating their microscopic structure, by Mr. S. Allport; Fossil Animal Life: Eozoon Canadense, the earliest known form of animal life, specimens showing the canal system and tubular wall of the chambers, and decalcified specimens showing serpentine casts of the canals, by Rev. H. W. Crosskey; Trilobites from Wenlock shale and limestone, Dudley, by Mr. E. Hollier; Crag Fossils and Devonian Fossils, by Mr. W. Graham; Pleistocene Animals from Cresswell Crags, by Mr. T. Heath; Chalk and Lias Fossils, by Mr. H. A. Vincent; Agates, Jaspers, Porphyries, &c., collected from the Drift, near Redditch, by Mr. W. T. Heming; and a very extensive collection of specimens, illustrative of the Glacial epoch, by the Rev. H. W. Crosskey. This collection must be referred to at some length. It illustrated both the physical action of ice and the changes of fauna connected with the epoch. The illustrations of the physical action of ice comprised (1) a specimen of encrinital limestone taken from beneath a mass of boulder clay. The stems of encrinites were shown, cut into sections and polished by ice action. (2) Ice-marked boulders, covered with balani, showing that they had been dropped by icebergs into the sea. (3) A

large collection of boulders of North British and Welsh rocks, found in the midland counties, and brought from considerable distances by the icebergs that drifted over the Midland sea. The extensive collection of the fauna exhibited might be divided into three groups:—(A) Specimens of the fauna of the extreme Glacial Epoch, from Scotland, Norway, and Canada, including Leda arctica, Pecten aratus, Pecten islandicus, Panopæa Norvegicæ, Astarte borealis, Velutina lævigata, Trophon clathratus, Littorina limata, and very many extremely rare Arctic species. A mass of the northern coral, Lophohelia prolifera, was also exhibited, taken from a glacial bed in the Christiania Fjord. (B) Specimens of the fauna that immediately succeeded that of the Glacial Epoch, showing the coming of milder climatic conditions, both in Britain and in Norway. (C) Specimens of the fauna of the most modern raised sea beaches. Any one who carefully examined the numerous and very interesting specimens contained in these three great groups of beds could readily trace the physical and climatic changes of the epoch.

The Biological specimens were numerous and very fine. Mr. D. W. Crompton exhibited a complete collection of British Hawks, (excepting the Jer-falcon, now supposed extinct in Great Britain;) foreign pheasants, including Gold and Silver Pheasants, East Indian; Lyre Bird, Australian; Lady Amherst Pheasant, having remarkable long tail; Peacock Pheasant of Thibet, having two embossed eyes on each feather of tail; Impeyan Pheasant, from Himalayan Mountains, fine colouring and metallic lustre; Scarlet and White Ibises of South America; Sacred Ibis of Egypt; Glossy Ibis of Europe; Egret, from South America, very delicate white feathers in two plumes from shoulder. Mr. Montagu Browne, Naturalist, Birmingham, made a magnificent display with an extensive collection of Animals, Birds, Fishes, Reptiles, Insects, &c., including the following:—Animals.—Badger, (Meles Taxus, L.,) from Northampton; Otter, (Lutra Vulgaris,) with young, from Ireland; Wild Cat, (Felis Catus,) from Scotland; Ermine, (Mustela Erminea, L., from Sutton Park; Mole, (Talpa Europea,) with cream-coloured variety of same, from King's Norton; Fox, (Canis Vulpes,) and young, from Scotland; pair of Duck-billed Platypus, (Platypus Anatus,) from Gipp's Land, Australia. Birds.—Pair of Imperial Eagles, (Aquila Adalberti,) from Spain; pair of Peregrine Falcons, (Falco peregrinus, Briss,) Scotland; pair of Snowy Owls, (Surnia nyctea, L.,) Labrador; Eagle Owl, (Bubo ignavus, Forst,) Archangel; pair of Little Owls, (Athene noctua, Retz,) Spain; pair of Bee-eaters, (Merops apiaster, L.,) Spain; Great Grey Shrike, Lanius excubitor, L.,) Wylde Green; pair of Long-tailed Tits, (Acredula rosea, Blyth,) with nest, Lichfield; pair of Pintail Sand Grouse, (Pterocles alchata, L.,) from Spain; pair of Willow Grouse, (Lagopus albus, Gm.,) Norway; pair of Greek Partridge, (Caccabis Græca, or Chucar?) Cyprus; pair of Buff-backed Herons, (Bulbulcus ibis, Hasselq,) Spain; Phalarope (Phalaropus fulicarius, L.,) Hampshire; common Swan (Cygnus olor, Gm.,) District; common Sheldrake (Tadorna cornuta, Gm.;) Pintail Duck (Dafila acuta, L.;) Teal (Querquedula crecca, L.); Eider Duck (Somateria mollissima, L.;) pair of Puffins, (Mormon Arctica, L.,) Wales; little Auk, (Mergulus alle, L.,) Handsworth; Pomarine Skua, (Stercorarius Pomarinus, Temm.,) from Lichfield Racecourse; pair of Arctic Tern (Sterna Hirundo, L.,) from District, and many others; three ornamental mounts, illustrating Birds of Australia, South America, and the Malayan Peninsula, respectively; some of the latter very rare. Eggs.—Cetti's Warbler with nest, (Potamodus Cetti, Marm.;) Griffon Vulture (Gyps fulvus, Gm.;) Osprey, (Pandion haliætus, L., and other rare ones. Fish.—Pike, (Esox lucius, L.,) weight 20lbs., from Sutton. Reptiles.—Gangetic Crocodile, (Gavialis Gangeticus,) 12ft. long, from India. Insects.—The whole of the British Butterflies in one

mount; the whole of the British Hawk-moths, including the very rare Sesia Andreniformis, in one ornamental mount; various rare exotic insects. Skulls and horns of Tiger, various Deer, &c., &c. Other exhibits in this department were:—Long-eared Owls, living specimens, by Mr. C. E. B. Hewitt; Pike, 28½lbs. and 20½lbs., from Langorse Lake, Wales, and Barbel, 8½lbs., from Thames, by Mr. Adams Parker; Pike, 34½lbs., from Langorse Lake, Wales, and Goosanders, Male and Female, from Langorse Lake, Wales, by Mr. G. R. Hill; Pike from Earl's Wood Pool, by Mr. John Allday; a fine specimen of Deer's Head, (mounted,) by Mr. Henry Griffiths, jun.; Articulated Human Skull, a remarkably fine specimen, by Mr. W. R. Hughes. Mr. A. Franklin, Taxidermist, Birmingham, showed a collection of Birds, including Argus Pheasants from India, Capercailzies from Scotland, Heron in fine adult plumage, blue and yellow Macaw, sooty and snowy Owls, Swallow-tailed Kite, white Robin, and cream-coloured Sparrow, a large collection of British Coleoptera and Lepidoptera, and eggs, cocoon, and living specimens of Bombyx Pernii.

General Science was represented by the Phonograph, Telephones, and Microphone, exhibited in operation by Mr. Lawson Tait; a Microphone (new construction) and various optical and scientific apparatus, by Mr, W. J. Lancaster; microscopic mounting and collecting apparatus, and various scientific instruments, by R. Bailey; Chance's Compound Glass Lenses for the electric light for forts and ships of war, for defence against torpedo boats at night and other purposes in war, by Mr. J. Kenward; a working Model, illustrating the rigidity of the positions assumed by an endless chain suspended from a pulley and put into rapid motion, by Dr. Hopkinson; Geometric Pen, consisting of an arrangement of wheels and levers producing a combination of the compound pendulum curves with straight lines and circles or spirals, giving an infinite series of harmonic curves, by Mr. C. Pumphrey; and a series of interesting scientific experiments were exhibited by members of the Birmingham and Midland Institute Scientific Society, and comprised Diffusion Figures, Vortex Rings, Terrestial Magnetism Experiment, Arago's Disc, Weld's Sound Experiment and Chladni's Figures, Syren and Galton's Whistle, Nörremberg's Polariscope, Spectroscope, Determination of Oxygen in Air, Reciprocal Combustion, &c.

Art and Archæology furnished much that was attractive and interesting. Mr. Allen E. Everitt contributed from the riches of his portfolios fifty of his charming drawings, chiefly illustrative of "Old Warwickshire." Thus he showed sketches of Birmingham:—Old Houses, Deritend; Digbeth Tripe House, Town Hall and Ann Street, Dog and Duck, Holloway Head; Aston: Great Staircase of the Hall, the Gallery ditto, Monuments inside of Church, ditto S. side of ditto, Holte Monuments N. aisle, Church from S.E.; Castle Bromwich: Hall from S.W.; Chimney Piece at Sheldon Hall; High Street, Solihull; East End of N. Aisle Solihull Church; Berry Hall, two views; Maxtoke Priory: The Gatehouse, Central Tower of Church; Little Packington: Church from N.W.; Berkswell: Church from S.E., Interior (under repair,) South Porch; Coombe Abbey: Queen Elizabeth's Room, Entrance to Chapter House; Stratford-upon-Avon: Chancel (two views,) Interior of Shakespeare's Kitchen; Wixford Church, Interior; Quadrangle, Coughton Court; Old Cottages at Haselour; Old Cottages at Tiddington; Interior of Coughton Church; Interior of Curdworth Church, Old House in Village; Water Orton: The Bridge, Old House near ditto; Hoggerell's End, an Old Farm House; Kingsbury Church from S.E.; Sutton Coldfield: Old Cottage in ruins and Yew Tree; Interior of Baddesley Clinton Hall; Temple Balsall: Church from S.W., Interior of Old Hall; Rowington: Village and Church, Shakspeare House; Entrance Hall, Tamworth Castle; Old Stalls, Astley Church; The Old Hall, Packington; Interior

of Baddesley Clinton Church; Iron Gates in Garden, Packwood; Tower of Edgbaston Church. Mr. J. R. Holliday exhibited Photographs, selected from a large number which have been taken during the last three years, of Warwickshire Churches, and Old Houses in the Midland Counties, principally Warwickshire, Worcestershire, and Gloucestershire. The two last-named counties furnished several specimens of the very interesting class of houses built in the seventeenth century, of stone and timber. The photographs of these, exhibited at the Conversazione, were taken at Laverton and Child's Wickham; and there were some of a fourteen century house at Broadway. The Laverton and Child's Wickham houses are being rapidly improved off the face of the earth, and several have entirely disappeared since Mr. Holliday photographed them, their places being supplied by hideous modern erections. The Warwickshire houses, of which there were photographs exhibited, were mostly of the sixteenth century, and comprised a very interesting example from Knowle, and Goscot Hall, near Redditch. Of Churches, there were photographs of Hampton-in-Arden, Brailes, Packwood, Curdworth, Wotton Wawen, Wappenbury, Lapworth, Whitchurch, and others. There were also the *Nature* series of Portraits of Scientific Worthies, exhibited by Mr. W. R. Hughes; a set of tinted etchings from old Dutch paintings, by Mr. W. P. Marshall; photographs of Pumping Engine Stations of the Birmingham Corporation Waterworks, by Mr. R. M. Lloyd; old engraved copper-plates, by Mr. C. T. Parsons; Greek and Roman remains from Fayoum, Egypt, by Mr. J. Courtenay Lord; Roman Pottery, from Leicester, by Mr. W. J. Harrison; Stone Hatchets and Indian Pottery from the Cordilleras, Central America, by Dr. Schwarz; and Rubbings from Ancient Brass and Stone Cross, and Flint Implements, by Mr. Lawson Tait.

Of other exhibits which contributed to the interest of the Conversazione we can only specify Mr. A. Pumphrey's ingenious method for producing in exact fac-simile an unlimited number of copies of pen and ink drawings, &c., (see "Midland Naturalist," p. 132,) which was exhibited in operation all through the evening; another, but quite different process, exhibited by Mr. J. Pumphrey, for easily and rapidly producing a number of copies of letters and other manuscripts, written with the exhibitor's special "aniline ink;" Diving Apparatus and Dress used in submarine operations and flooded mines, &c., exhibited by Mr. J. Place; and a steady and useful revolving table for microscopical work, with slate top and substantial iron stand, exhibited by Mr. T. Bolton.

In concluding this account of a most pleasant and instructive exhibition, we must not omit to state that the success of the Conversazione was mainly due to the excellent arrangements made by Mr. W. P. Marshall, (who undertook the general management,) and Messrs. J. Morley and C. Pumphrey, Rev. H. W. Crosskey, Messrs. W. B. Grove, J. Levick, and others.

EXCURSION TO DUDLEY.

On the following day, Tuesday, May 28th, Members of the Union and their friends, to the number of nearly 400, made an excursion to Dudley and the neighbourhood, under the auspices of the Dudley and Midland Geological and Scientific Society and Field Club, representatives of which received the party at the Tipton Station of the Great Western Railway, and conducted them in the first instance to the Open Coal Work at Foxyards, where the Ten-yard Coal Seam exposes its point of outcrop on the east side of the obtruding ridges of the Dudley Castle Hill and the Wren's Nest. Mr. Thomas Latham, the Earl of Dudley's Mine Agent, gave interesting information as to the mode of getting the coal, and under his direction a fall of coal was displayed. The

excursionists, who were joined by a numerous body of the general public, next proceeded to the Wren's Nest Hill, which is picturesquely situated on the north side of Dudley, is remarkable in its formation, which is that of an elevated elliptical dome, for the extent of the mining operations in the Limestone strata and for the wild and rugged beauty of some of its scenery. The inspection of the "Daylight Caverns" afforded much pleasure. The party next passed through the private grounds of E. Fisher Smith, Esq., and thence to the Priory Ruins. The Priory was founded in the middle of the twelfth century by Gervase Paganel. A description of the ruins was given by Mr. Rupert Smith, C.E. The celebrated silurian caverns, which were illuminated, were next visited. Passing shady dells and sylvan hills, the company afterwards reached the ancient Court Yard of Dudley Castle. After Luncheon came the crowning event of the day—the descent by more than 400 persons, including many ladies, of the famous Lye Cross Coal Pit, at Rowley, which was superintended by Mr. Latham. This pit is remarkable as being the first sunk through the Basalt, or Rowley Rag. Where the pit was commenced the thickness of the basalt was unknown; it proved to be no more than 68 yards, when the rock binds of the coal measures were reached. At 168 yards the Two-foot and Brooch coals were met with, and at 228 yards the Thick coal was cut into. The pit is 258½ yards deep. The gate roads are very wide, high and dry. Mr. Rupert Smith and Mr. Thos. Latham and his son did all in their power to interest and instruct their many visitors, and they certainly succeeded to admiration. The warmest thanks of the members of the Union are due to them for their kindly courtesy, and for the trouble they took. The excursion was made by special permission of E. Fisher Smith, Esq., on behalf of the Right Hon. the Earl of Dudley. The arrangements of the day were carried out by Mr. Marten, Mr. Hollier, and others connected with the Dudley Geological Society.

THE MICROPHONE, MAGNOPHONE, PHONOSCOPE, AND PHONEIDOSCOPE.

BY W. J. LANCASTER, F.C.S., F.R.A.S.

Having exhibited a Microphone of my own construction, and noticed with much pleasure the great amount of interest displayed by the visitors to the conversazione of the Union of Scientific Societies in our Town Hall, I have thought a short description of the Microphone, together with a description of its associated scientific instruments lately discovered, would not be out of place in "The Midland Naturalist." The Microphone, as discovered by Professor Hughes, consists essentially of several pieces of charcoal, connected in circuit with a few cells and a telephone, a simple form being made by having two plates of gas carbon glued to a thin piece of wood and being about 1½in. apart, and a cylindrical piece of gas carbon, ½in. diameter, sufficiently long to fit loosely in an indentation in lower part of top carbon plate, and in the upper part of bottom plate, the ends of the rod being tapered to a point; the thin board containing this Microphone may be glued to the end of a stronger piece of board, so that the rod is in a vertical position; by connecting the upper and lower plates in the circuit from two screws, sounds are immensely amplified. A form of Microphone which serves equally well for the detection of minute sounds as for the transmission of speech is the Pile Microphone, which I refer to above. This instrument consists

of a polished box, about 5in. by 4in. by 1in., without a bottom board, on the top of this a plate of zinc, 4in. by 2½in., is screwed, this forming the bottom element; then above this is a plate of carbon of equal dimensions. To one end of this plate an upright turned piece of wood, 1in. long, is either screwed or glued, and on the top of this a second plate of carbon, 2in. by 1½in., is screwed. This plate has a binding screw connected with it, and is connected to the lower plate by means of a thin rod of carbon, 1½in. long, pointed at the bottom end. Having the instrument finished, all that is necessary is to moisten a pad of blotting paper with a solution of sulphuric acid and bichromate of potash, in the proportion of one each acid and bichromate and ten of water. Place the pad between the carbon and zinc plates, and the instrument will detect the most minute sounds. For minute sounds the carbon rod should be nearly upright, and for speech should be inclined as much as possible. The Telephone is to be used in circuit, but this may be dispensed with by using a few electro-magnets, made of ⅛in. iron and bent into the form of a triangle, so that the poles will nearly touch each other. Four of such magnets make a very good receiver. Mr. Blyth has obtained a receiver consisting merely of a box of cinders, with a plate of tin at each end; but although I have repeated his experiments I have failed to obtain favourable results. A simple form of receiver will be obtained in a few weeks, and will at once supersede the Telephone.

The Magnophone is an addition to the Telephone, by W. L. Scott, and consists in the application of small particles of iron on the back of an ordinary Telephone plate, (the plate itself being in the circuit from a series of Daniell's or other cells,) and in the use, as transmitters, of the particles of either iron, silver, gold, or platinum in a state of minute subdivision, or if pieces of asbestos, pumice, or other bodies be saturated with *(e. g.)* mercury, these phonophoric tablets may be placed in the circuit with pointed ends touching each other, and will then transmit sounds in a similar manner to the Microphone. In fact, the Magnophone resembles the Microphone in so many details that it ought rather to be called a Microphone.

The Phonoscope is a very beautiful adaptation to an induction coil and rotating vacuum tube. This may be done in the following manner:—At the end of a conical tube a thin membrane is stretched, and behind it a thin plate of platinum, about one-eighth of an inch wide, is attached in a bowed form; immediately behind this strip of platinum a third point of platinum is fixed into a brass spring. The instrument is a simple form of contact breaker, and contact is made by speaking into the conical tube. Supposing now the tube to be revolving, and the two terminals from secondary of induction coil to be connected to the two pieces of platinum, it is evident that by speaking into the conical tube contact is made and broken in proportion to the period of vibration of the stretched membrane, and the tube will be illuminated when contact is made, and will thus reveal the peculiar condensations, &c., of a sonorous wave. This simple though beautiful adaptation to the induction coil was exhibited by Mr. H. Edmonds, jun., at the conversazione of the Institution of Civil Engineers.

The Phoneidoscope is simply a tube bent at right angles, and having an orifice, which may be of any form, covered with a thin film of soap. The film should appear coloured, and then, by speaking into the tube, or sounding a tuning fork, the colours arrange themselves in a manner very similar to the sand in Chladni's figures. The experiment is an instructive one.

Plate III.

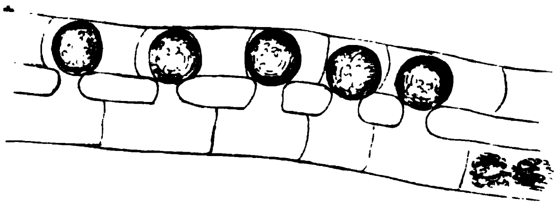


Fig 12 × 200.

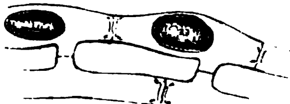


Fig 13 × 100

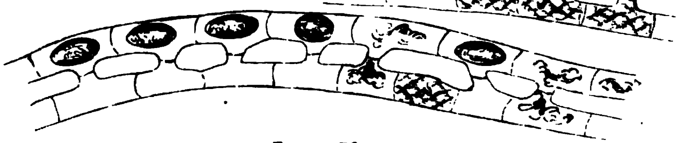


Fig 14 × 50.

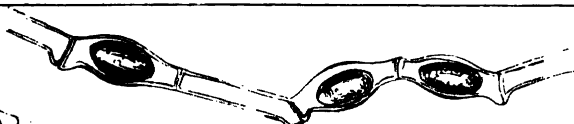


Fig 17 × 170.

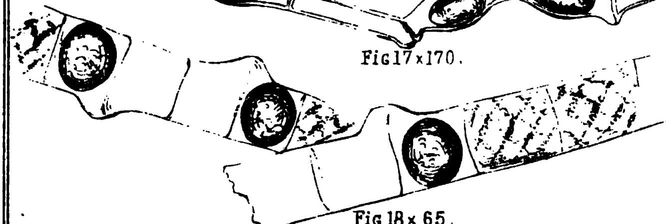
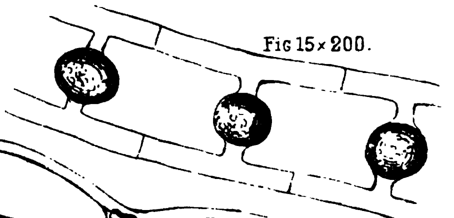


Fig 18 × 65.

Fig 15 × 200.



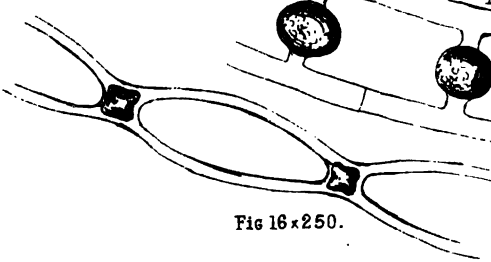


Fig 16 × 250.

A. W. WILLS del et lith.

FRESHWATER ALGÆ.*

BY A. W. WILLS, F.C.S.

(*Continued from page 148.*)

The last great family which remains to be noticed is that of *Conjugatæ* or *Zygnemaceæ*.

These plants consist essentially of transparent elongated cells, placed end to end in long filaments, and containing in their interior masses of endochrome variously arranged; in *Zygnema* disposed in twin stellate radiating forms; in *Spirogyra* in one or more spiral bands running round the walls and presenting at intervals bright points, usually consisting of starch-globules; the whole forming objects of singular elegance and beauty.

In all the genera belonging to this large family, but especially in the two just named, the phenomena of cell-division may be readily observed, (taking place through a nucleus usually suspended in the centre of the cell, and often very conspicuous,) and as all the cells of an individual filament frequently undergo simultaneous reduplication in this manner, its growth is enormously rapid.

The formation of zoospores is exceptional in the *Conjugatæ*, the more constant mode of reproduction being by the process of conjugation, now familiar to most microscopists. But as this is a phenomenon of the greatest interest, and as the illustrations given in text books are for the most part merely diagrammatical, we shall briefly describe it, and append sketches taken from our own specimens.

We have recently observed in decaying or unhealthy filaments of more than one species of *Spirogyra* and *Zygnema*, the conversion of the endochrome into numbers, varying from 4 or 5 to upwards of 100, of small spherical or oval bodies resembling zoospores, and possessing a similar though generally more sluggish and irregular motion; but, although we have watched their progress for several days together, they are seldom seen to escape from the cell, and even those which do so appear to undergo no further development. Nägeli is, we believe, the only writer who has recorded a similar observation, and he concludes that these "Infusorioid structures" are "incapable of development or only of abnormal development." Still it is difficult to believe that this phenomenon, so distinct in its character, has no physiological significance; it may, perhaps, be considered to present one of the unsolved problems in Algology.

* We still except from our remarks the Diatomaceæ, which, if dealt with at all, would require more space than is consistent with the limits of the present article.

DESCRIPTION OF FIGURES IN PLATE III.

Fig. 12.—*Zygnema lutescens* in conjugation.
Fig. 13.—*Spirogyra inflatum* in conjugation.
Fig. 14.—*Spirogyra neglecta*, showing various stages of conjugation.
Fig. 15.—*Mesocarpus scalaris*, showing formation of spores in connecting tubes.
Fig. 16.—*Staurocarpus gracilis* in conjugation.
Fig. 17.—*Spirogyra angularis*, showing formation of spores from contents of contiguous cells in one filament.
Fig. 18.—*Spirogyra woodsii*, showing formation of spores from contents of contiguous cells in one filament.

Conjugation, as the term implies, consists of the yoking together of two contiguous filaments which, by some mysterious means, approach one another and assume a position of strict parallelism. Projections are then thrown out between opposite pairs of cells, and gradually increase till they finally meet and form connecting tubes. At the same time the endochrome loses its spiral arrangement, and becomes an irregular, confused mass. [Plate III., Fig. 14.] It then passes, as in *Zygnema* [Plate III., Fig. 12] and *Spirogyra*, [Figs. 13, 14,] into the opposite cell and there, mingling with the contents of the latter, forms a round or oval spore with distinct cellulose coating; or, as in *Mesocarpus* [Fig. 15] and *Staurocarpus*, [Fig. 16,] meets the contents of the opposite cell, which move forward to join it, in the connecting tube, and there forms a spherical or cruciate spore.

A curious modification of this process occurs in some species of *Spirogyra*, where the spores are formed not from the contents of two opposite cells of different filaments, but by the union of those two contiguous cells of the same filament, the mingling of which is effected through a little tube bridging over, as it were, the septum between them. [Plate III., Figs. 17 and 18.] It is asserted by some writers that this phenomenon is abnormal, and occurs in species which usually conjugate in the ordinary way; but the writer has only once seen the two processes occurring simultaneously in the same plant, and has always observed this form of conjugation in specimens the proportions of which stamp them as distinct species.

The most striking point about the operation just described is the assumption by the contents of the cells of *different* plants, or by those of *special* cells in the *same individual*, of the opposite properties upon which depend respectively the powers of *imparting and receiving fertilisation*, although the most careful scrutiny under the highest powers of the microscope fails to reveal the least difference in their condition. It has been stated that this polarisation, as it may fitly be termed, in the ordinary form of conjugation, is capricious, the cells of the two filaments assuming indiscriminately these converse functions, but in the many hundreds of specimens which we have examined and mounted, we only remember finding one exception to the rule that all the cells of one conjugating filament assume "male" and those of the other "female" sexual functions; this exception occurred in the specimen already referred to, in which conjugation of contiguous cells of the same individual also took place, and in this case the spores formed in one filament were large, while those in the other and alongside of the cells which had discharged their contents were much smaller, and apparently imperfectly developed.

It now remains to answer the two last questions which we proposed in the outset, viz.:—How are the Algæ best collected? and how should observations on their structure, &c., be recorded?

The larger filamentous Algæ are best brought home in small glass tubes of thick glass well annealed.

A compact form of collecting apparatus consists of a number of

pieces of strong glass a couple of inches square, to each of which is cemented with gold size or marine glue an indiarubber ring about one-eighth of an inch thick. These, when piled on one another, and held together by indiarubber rings, take up but little space. Lastly, for these coarser plants nothing answers much better than to screw them up in bits of strong paper and bring them home in a wide-mouthed bottle, tin box, or even loose in the pocket. A specimen need, at any rate, never be left behind for want of a more elaborate vasculum.

The *Desmidiaceæ* require more care, and the gathering should be transferred with as little shaking as possible to one of the glass tubes which should be *filled* with water.

It is a useful plan, when out for a long walk, to number the specimens, and note down their exact habitat in a pocket book. Some years ago the writer returned from a five and twenty mile walk across the Welsh Mountains, with some fifty "dips" of all sorts. Next day was devoted to their examination, and in one tube, among a quantity of common species, were found two frustules of *Docidium nodosum*, a Desmid hitherto recognised as exclusively an American species, but which has been since found, we believe, by Mr. Archer, in Ireland. Unfortunately, no such record as we suggest had been kept; and, although the writer started off next morning at daybreak, took exactly his previous route, and searched sedulously till nightfall in every tiny pool in which he remembered dipping in his previous ramble, not a trace of the new plant was found.

The specimens being brought home, each should be transferred in turn to a small saucer, or watch-glass, and portions of it examined under a convenient power, generally about half an inch. If any new species is spotted, it should be set aside for mounting, duly labelled temporarily; but, if the gathering seem to contain nothing but old friends, it is a useful plan to give it a parting squeeze between the fingers, and catch the drippings in a watch-glass. Small Desmids and Diatoms, previously entangled, are pressed out in this way, and new species often reward the examination. The squeezed mass should not be thrown away till the washings have been searched over. *It often pays to repeat the process.*

A specimen should never be thrown away because it is a poor one, or consists of one individual, where a dozen would be acceptable. The rarest plants are naturally often met with singly. Once, in examining a mass of very dirty stuff from a Welsh bog, the writer pounced in his first dip on the rare Desmid, *Micrasterias radiosa*. Rashly concluding that there were sure to be plenty more, he swilled back the contents of the slide into the mess. But dip after dip, and washing after washing, were examined in vain; and, as the species was too rare to be lightly lost, it cost the work of two long nights to hunt over the entire mass, drop by drop, till the individual plant, whose diameter was about 1-140th of an inch, was recovered.

We say, therefore, *mount a poor specimen rather than none. If you find a better you can throw it away, or give it to a friend, who will value it.*

It is worth adding that the Desmids are easily separated from other plants by shaking the gathering up in a tube and pouring the whole into a watch glass, when, from their higher specific gravity, they sink to the bottom, and, by a little careful manipulation, may generally be recovered quite clean and free from dirt.

The methods of mounting the various classes of Algæ we reserve for discussion in a subsequent paper. For the present let it suffice to state that, by attention to certain indispensable details of manipulation, these plants may be preserved for *indefinite* periods.

A few words, in conclusion, on the subject of recording observations made under the microscope. All Algæ, however carefully mounted, do, in course of time, more or less lose their exact form and natural appearance. Hence it is most desirable to supplement their collection by sketches in pencil, pen and ink, or other material, *made from the living plant.* Various ways of doing this are recommended, but we have found the use of what is known as a neutral-tint reflector, to be by far the easiest and most effectual. This apparatus consists simply of a piece of the thinnest possible microscopic glass, fitted into a cap, which replaces that of the ordinary eye-piece, and holds the glass-plate at an angle of 45° to the axis of the instrument. It is, in fact, a miniature Pepper's ghost arrangement; and the microscope being clamped in a horizontal position and focused, upon looking down upon the glass-slip the observer sees the image of the object reflected to the eye, but apparently at a distance below the reflector equal to that between it and the object itself. By placing a sheet of paper on the table underneath, and adjusting the *relative* illumination of the object and the paper, so that the point of a pencil is clearly seen on the latter, it becomes easy, with a few hours' practice, to trace the smallest details. In practice, it is best, however, to obtain an accurate outline in this way, and the *spirit* of the object is better given by filling in details from direct vision in the microscope.

This method gives a drawing perfectly accurate, and to a scale easily ascertained.

Many of the descriptions given in Hassall's "Freshwater Algæ,' the only systematic work upon this subject in the English language, are wholly useless from the absence of all dimensions, and it is impossible to decide whether the species described are really distinct ones or are needlessly multiplied, by reason of this vital defect. It is of primary importance that dimensions should be in all cases recorded in fractions of an inch or in millimetres; and the following method of ascertaining them at a glance will be found simple and satisfactory.

A plain circle of strong glass may be obtained from any optician, of size to drop into the focal point of the eye piece, and ruled into squares, conveniently of 1-50th of an inch. A glass slip ruled into thousandths of an inch is placed on the stage, and each of the objectives in ordinary use, say from ¼ to 2 inch, being screwed into its place in turn, it is only necessary to observe which divisions of the ruled eye piece correspond with the actual thousandth-lines in the slip to obtain a gauge of the dimensions of an object corresponding to each division of the eye-piece.

For example: the slip being so arranged that the left hand 1-1000th line corresponds accurately with one of those on the eye-piece, suppose that the 5th line of the eye-piece corresponds with the 9th 1-1000th line from the left on the slip. Hence five divisions of the eye-piece = 9-1000ths or 1 division = 9-5000ths = 1-555th of an inch. In this manner the actual value of one division of the eye-piece for *each power* should be registered once for all: it is then the work of a moment to record the actual dimensions of any object under examination.

If such records were kept systematically by observers, a comparison of their observations would go far to facilitate a harmonious classification of a large and beautiful tribe of plants, the bibliography of which is at present most unsatisfactory, and has suffered grievously from a needless multiplication of supposed species, consequent upon imperfect observations still more imperfectly recorded.

The object of this paper will be amply fulfilled if it induces some of the Naturalists of the Midland counties to engage in the study of these minute organisms, and to do their share towards elucidating the many points in their physiology which are still obscure.

ON THE STUDY OF THE MOSSES.—II.

BY JAMES E. BAGNALL.

In my last paper (page 59) the material and apparatus required for the collecting and study of these plants were treated of. In the present I purpose giving some account of the development of Mosses.

Mosses are cellular plants, having distinct stems, leaves, and roots, (the Sphagnums or bog-mosses are exceptional, as they do not possess roots;) they have a capsular fruit, and are developed from spores, (*seed-like contents of ripe capsule*, Plate IV., fig. 1,) or gemmæ, (*cellular bodies capable of becoming plants*, fig. 2*d*.)

DESCRIPTION OF FIGURES.—PLATE IV.

1.—Spores of moss.
2.—Gemmiform state of *Aulocomnion*, *a* stem, *b* stalk, *c* gemmæ, *d* gemma detached and magnified.
3.—*A* protonema, *bb* young mossplants.
4.—Species of *Pottia*, to show terminal fruited moss, *a* stem, *b* fruitstalk, *c* capsule, *d* conical lid.
5.—Species of *Hypnum*, to show lateral fruited moss, *a* fruitstalk, *b* capsules.
6.—Leaf of *Hypnum*, to show nerve, *a* nerve, *b* margin.
7.—Male flower of moss, *a* Antheridium, throwing off a number of Antherozoids *c*, *bb* paraphyses.
8.—Antheridium of *Sphagnum*.
9.—Archegonium of moss, *a* neck, *b* pear shaped body, *c* germ cell, *d* canal.
10.—Fruit rudiment, *a* calyptra, *b* rudimentary fruitstalk, *c* vaginula.
11.—Indehiscent capsule of *Phascum*, *a* capsule, *b* fruitstalk, *c* vaginula.
12.—Simple peristome of *Tetraphis*, *a* conical operculum, *b* peristome, *c* capsule.
13.—Strumose capsule of *Dicranum falcatum*, *a* rostrate operculum, *b* struma.
14.—Capsule of *Splachnum*, *a* operculum, *b* capsule, *c* apophysis.
15.—Prosenchymatous cells from leaf of *Bryum*.
16.—Parenchymatous cells from leaf of *Pottia*.
17.—Inflated dimidiate calyptra of *Funaria*.
18.—Dimidiate calyptra of *Tortula*.
19.—Capsule of *Andreæa*, dehiscing by valves *a a*.
20.—Part of double peristome of *Hypnum*, *a* inner peristome, *b* outer peristome.
21.—Capsule of *Polytrichum*, *a* capsule, *b* peristome, *c* diaphragm.

The spores are minute, round, cellular bodies, varying in size, colour, and external marking, and are composed of two membranes or coats, an inner and an outer one, enclosing a thickened granular mass. Though similar in function to the seeds of flowering plants, they differ from those organs, in being capable of germinating from any part of their surface, and in possessing no embryo, *(the young plant contained in the seed;)* hence plants developed from spores are termed Acotyledons, (Gr. *a*, without, and *kotuledon*, a seed-lobe.) The spores which are formed in the capsule are the bodies from which the moss-plant is normally developed.

But many even of our common Mosses rarely produce their fruit, and are perpetuated in other ways, as, for instance, by gemmæ, which may be seen forming little globular heads (2*c*) on the top of a pale, naked stalk (2*b*) in *Aulacomnion androgynum*, (2,) so frequent on wayside banks,* or from thread-like cellular bodies, abundant on the leaves of some Mosses, *Orthotrichum Lyellii*, for instance, frequent on poplars, elms, &c., or from bud-like bodies formed in the axils of the leaves, as in *Bryum annotinum*, found on sandy banks, or even detached leaves may give origin to a new plant, as in *Campylopus pyriformis*, frequent on heath lands.

When the spores germinate, they give rise to a green thread-like body, called the protonema, (3*a*,) which is formed by the protrusion of the inner membrane of the spore through the outer one. This, by frequent cell-division, becomes elongated and branched. The primary branch, at first green, frequently turns brown, and, in some cases, penetrates the ground and performs the function of a root. The secondary branches are well charged with chlorophyll, *(green, granular matter in the interior of the cell,)* and branch frequently. On various parts of the protonema bud-like bodies arise, (3*b*.) These are the rudimentary moss-plant. From the buds roots are sent down into the medium, on which they grow. By frequently repeated cell-division these buds develope into the leafy moss-stem. Mosses, like Ferns, Horsetails, &c., grow at the apex only, and are hence termed Acrogens, *(plants which increase at the summit only.)*

The protonema, which looks very like masses of green conferva, may be seen forming a velvety mass on the ground in the neighbourhood of Mosses; and if a portion of such masses is examined with the microscope, all the stages of growth may frequently be seen. In most Mosses the protonema is short lived, perishing before the moss-plant is fully grown; but in some of the lower forms, as in *Phascum serratum*, it lasts throughout the plant's lifetime. This Moss may be found in fallow fields in Autumn and Spring. The gemmæ, above-mentioned, germinate much in the same way as spores, forming first the thread-like protonema, upon which the leafy stem is developed.

The stem varies in length considerably; in some Mosses it is imperceptible without a lens, as in *Phascum serratum*, but in many others it is very apparent. It may be erect, as in *Polytrichum*; or prostrate, as in some of the *Hypnums*, or feather-mosses; simple, as in *Pottia*, (4); or

* (2*d*) is one of the gemmæ detached and magnified.

branched, as in *Hypnum*, (5). In some of the terminal-fruited mosses it branches by what are termed innovations; these are extensions of the stem, often arising at the top of the old stem, and such branching is usually forked, each fork representing a year's growth. This mode of branching may be seen in many *Bryums*, and other mosses; a convenient example occurs in *Grimmia pulvinata*, the little hoary, cushion-like patches of which may be seen on wall-tops and thatch.

The stem and branches are more or less densely clothed with leaves, which are always simple, (undivided,) and vary in shape from awl-shaped to round, the most frequent forms being lance-shaped, or oval. The leaves vary in structure, but are usually formed of a single layer of cells; exceptions occur, as in *Leucobryum;* in this case the leaves are formed of three layers of cells.

The cells forming the leaf assume a variety of forms, but may be referred to two types—I. Parenchymatous, *(having the cells placed end to end,)* as in *Pottia*, &c., (16); II. Prosenchymatous, *(having cells which overlap one another at their ends;)* these have pointed ends, and are longer than broad, as in *Bryum*, (15). The study of these leaf-cells is one of great importance, as the generic and specific differences of many Mosses are often made out by the character of the cells forming the leaf. Among other forms assumed by cells we have round, as in *Zygodon;* quadrate, as in *Pottia;* hexagonal, as in *Tetraphis;* oblong, as in *Isothecium;* rhomboid, as in *Bryum*, &c. The cells at the base of the leaf are frequently of different form from those of the upper part of the leaf, and are often colourless and transparent.

The centre of the leaf is often occupied by elongated cells, forming what is called the nerve or midrib (6*a.*) This nerve is usually simple, but may be forked as in *Isothecium myurum*; or there may be two nerves, as in *Hypnum triquetrum*, common on marly banks; or the leaves may be nerveless, as in *Hypnum stellatum*. The nerve is of variable length, in some cases vanishing below the tip of the leaf, in others projecting beyond the tip and forming a short point or mucro, as in *Tortula marginata;* or it may form a long transparent hair-like point, as in *Tortula muralis*, a Moss very frequent on wall-tops.

The leaves are placed spirally upon the stem and branches, their arrangement being various, as $\frac{1}{2}$ or distichous in *Fissidens*, $\frac{1}{3}$ or tristichous in *Anœctangium*, 2-5ths in *Pottia*, or $\frac{3}{8}$ as in *Bryum*. Their direction is variable, and it is advisable to pay attention to this. Sometimes they are crowded and imbricate, *(overlapping like tiles,)* as in *Bryum argenteum*, common on walls; or they may be spreading as in *Tortula fallax*, which may be seen on sandy or clayey banks. In some species secund, *(curved to one side,)* as in *Dicranella heteromalla*, frequent on wayside banks; in others remarkably recurved at the tips or what is termed squarrose, as in *Hypnum squarrosum*, to be found on heath lands and in woods.

When dry the direction of the leaves is often very different from that assumed when the plant is moist. Thus in *Bryum capillare* the leaves are spreading when moist, but much twisted when dry; in *Tortula spadicea* much spreading when moist, but closely imbricate when dry;

but experience will soon show that these characters vary in different species of Moss. The margin of the leaf, (6*b*,) is sometimes plane, at others formed of a double row of cells and hence thickened, as in *Tortula marginata*; in some cases entire, in others variously toothed. In some species, *Weissia controversa*, for instance, it is involute, *(rolled over towards the upper surface;)* in others revolute, *(rolled over towards the lower surface,)* as in *Tortula revoluta*, to be found on wall tops; or the leaf may be rolled upon itself from side to side, or convolute, as in the leaves surrounding the base of the fruit-stalk of *Tortula convoluta*, and in some case as in *Atrichum undulatum*, the margin is undulated. The leaf-surface is usually smooth, but in some species, such as *Thuidium tamariscinum*, it is covered with minute projections, and is termed papillose. The leaves vary in colour, being of every shade of green, in some cases reddish, in others brown, or again, as in *Leucobryum glaucum*, nearly white.

Mosses are often termed flowerless plants, which is a misnomer, as both male and female flowers occur on these plants, and may readily be found in most species when the leafy stem has arrived at maturity. In many of our Mosses, as in the *Bryums* and *Polytrichums*, they occur as star-like bodies at the top of the stem; in others, such as the common *Hypnum rutabulum*, both male and female flowers may be found as bud-like bodies in the axils of the stem-leaves. In the bog-mosses or *Sphagnums* they occur in pendulous catkins, which are often tinged with red or brown.

If these flowers are dissected it will be seen that they consist of a number of leaves surrounding or enveloping the organs of reproduction, the Antheridia, *(bodies which perform the function of an anther, 7a,)* *i.e.*, the male; or the Archegonia, *(bodies which perform the function of a pistil or ovary, 9,)* *i.e.*, the female reproductive bodies. The leaves surrounding the antheridia form what is termed the perigonium, *(that which surrounds the male organ;)* those surrounding the archegonia form the perigynium, *(that which surrounds the female organ.)* The male flowers are sometimes developed in the axils of the ordinary leaves, and have no perigonium, as in *Sphagnum*.

[TO BE CONTINUED.]

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF MAY, 1878.

BY. W. J. HARRISON, F.G.S..

The first few days of May were tolerably fine and clear, but on the 7th rain began to fall, and continued daily until the 29th, thus giving twenty-three consecutive days of rain! As one observer succinctly puts it, this downpour "spoilt the promise of April; damaged the crops, and put everybody out of temper."

Erratum.—In remarks for April, read Swallow for Cuckoo at Kibworth on April 11th. Cuckoo did not appear there till May 2nd; very late.

STATION.	OBSERVER.	RAINFALL.				TEMPERATURE.			
		Total for M.	Greatest fall in 24 hours.		No. of rainy d.	Greatest ht.		Great'st cold.	
		In.	In.	Date.		Deg	Date.	Deg	Date.
GLOUCESTERSHIRE.									
Cainscross, Stroud	W. B. Baker, Esq.	6·65	1·68	10	28			84·0	21
Cheltenham	R. Tyrer, Esq.	4·99	1·08	10	24	70·0	10	33·0	21
Stroud	S. J. Coley, Esq.	6·01	1·65	10	24	72·0	1 & 10	38·0	20
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	5·9	1·08	10	26	67·0	1	36·0	21
Whitchurch	A. B. George, Esq.	5·23	1·10	8	28	66·0	17 & 19	42·0	22 & 24
Woolstaston	Rev. E. D. Carr	5·00	·88	9	24	69·0	1 & 2	35·0	22
Leaton Vicarage, Shrewsbury	Rev. E. V. Pigott	4·86	·86	8	28	68·6	12	34·0	21
More Rectory, Bishop's Castle	Rev. A. Male	4·92	·72	7	26	68·0	31	32·0	21
Larden Hall, Much Wenlock	Miss F. R. Boughton	5·38	·98	8	25				
Bishop's Castle	E. Griffiths, Esq.	4·98	·74	7	21	69·0	31	36·0	21
Cardington	Rev. Wm. Elliot	5·86	·86	8	26				
Adderley Rectory	Rev. A. Corbet	5·43	·95	7	24				
Stokesay	Rev. J. D. La Touche	5·09	·77	7	24	67·7	1	33·9	5
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	5·41	·99	10	27			32·0	5
Stoke Bliss	Rev. G. E. Alexander	5·56	1·06	10	25	66·0	12 & 18	38·0	21
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq.	6·12	1·23	10	25	68·0	18	33·8	21
West Malvern	A. H. Hartland, Esq.	6·80	1·31	10	27	69·0	1	34·0	20
Pedmore	E. B. Marten, Esq.	6·26	·96	10	24	70·0	1, 5, & 12	36·0	20
Stourbridge	Mr. J. Jeffries	6·02	·98	10	24	74·0	2	30·0	20
St. John's, Worcester	G. B. Wetherall, Esq.	6·56	1·28	10	24	69·0	1 & 18	36·0	21
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	5·57	1·12	10	25				
Barlaston	W. Scott, Esq.	5·20	·69	7	24	69·2	31	26·8	20
Amblecote	Mr. J. Robins	6·07	1·00	10	24				
Dudley	Mr. J. Fisher	5·06	·84	7	24	74·0	12	31·0	20
Sedgley	Mr. C. Beale	5·66	·90	8 & 10	25	65·0	5, 12, & 18	36·0	20
Kinver	Mr. W. H. Bolton	5·71	1·15	10	25	78·0	1	36·0	4 & 20
Walsall	Mr. W. E. Best	5·36	1·06	8	25	70·0	12	37·0	20
Grammar School, Burton	C. U. Tripp, Esq.	5·28	·80	7	25	73·0	2	35·0	21
Patshull Gardens	T. W. Dell, Esq.	6·50	1·08	11	26	72·0	6 & 30	33·0	21
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	5·85	1·05	10	25	74·0	12	35·0	21
Wrottesley	E. Simpson, Esq.	6·48	1·08	10	22	68·4	18	33·5	21
Tamworth	W. Arnold, Esq.	4·57	1·12	8	24				
Tean Vicarage, near Cheadle	Rev. G. T. Ryves	4·61	·74	7	24	68·0	2 & 18	34·0	21
The Heath House, Cheadle	J. G. Philips, Esq.	4·70	·78	7	24	60·0	6	33·0	21
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	5·98	·86	7	25	75·0	11	42·0	20
Coventry	J. Gulson, Esq.	6·11	·88	7	24				
Bickenhill Vicarage	W. R. Capel, Esq.	5·95	1·20	10	22				
St. Mary's College, Oscott	Rev. S. J. Whitty	4·75	1·12	10	25	68·2	12	36·0	21
Henley-in-Arden	T. H. G. Newton, Esq	5·78	1·83	11	27	70·0	1, 4, 5, 31	35·0	21
Rugby School	Rev. T. N. Hutchinson	5·12	·78	7	24	70·0	2	35·0	21
DERBYSHIRE.									
Buxton	E. J. Sykes, Esq.	6·04	·52	7	24	65·0	2	31·2	21
Brampton S. Thomas	Rev. J. M. Mello	4·09	·78	28	19	68·0	1	35·5	20
Stoney Middleton	Rev. U. Smith	5·07	·61	18	22	68·0	2	25·0	20
Fernslope, Belper	J. G. Jackson, Esq.	5·74	·75	8	24	69·0	12	36·0	21
Matlock Bath	R. Chadwick, jun., Esq.	5·94	·71	16	25	68·3	12	34·5	21
Linacre Reservoir, Ches'field	C. E. Jones, Esq.	5·48	1·99	28	25				
Willesley Gardens, Cromford	J. Tissington, Esq.	3·71	·76	9	20				
Stuffynwood Hall	Mr. R. Rolfe.	4·94	.71	18	25	71·0	2	35·0	20
Spondon	J. T. Barber, Esq	5·88	1·82	7	25				
YORKSHIRE.									
Tickhill, Rotherham	B. J. Whitaker	2·91	·46	7	28	72·0	14	34·0	21
NOTTINGHAMSHIRE.									
Hodsock Priory, Worksop	H. Mellish, Esq.	3·78	·55	6	25	72·7	27	32·9	21
Grove House, Mansfield	W. Tyrer, Esq.	4·87	·55	8	26	70·2	5	35·8	21
Tuxford	J. N. Dufty, Esq.	4·66	1·09	24	..	74·0	12	35·0	20
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	3·90	·89	7	28	74·8	17	37·1	20
Ashby Magna	Rev. E. Willes	4·79	·88	8	24	76·0	1	36·0	21
Market Harborough	S. W. Cox, Esq.	5·31	·90	8	25	68·0	2, 7, & 18	34·0	21
Kibworth	T. Macaulay, Esq.	4·98	·86	7	24				
Town Museum, Leicester	W. J. Harrison, Esq.	4·71	1·14	7	25	69·5	18	36·9	21
Belmont Villas, Leicester	H. Billson, Esq.	4·74	1·16	7	25	71·8	5	36·8	21
Syston	J. Hames, jun., Esq.	5·02	·99	7	26	76·0	6	37·0	21
Waltham-le-Wold	E. Ball, Esq.	3·72	·67	8	28	68·0	6	35·0	20
Little Dalby Hall	G. Jones, Esq.	3·80	·85	7	23	75·0	5	33·0	21
Coston Rectory, Melton	Rev. A. M. Rendell	3·76	·88	8	23	70·0	17 & 18	31·0	21
Belvoir Castle	W. Ingram, Esq.	4·40	·66	9	25	71·0	18	34·0	21
Foxton Locks	Union Canal Company	5·07	·82	8	22				
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	4·82	·82	7	21				
Castle Ashby	R. G. Scriven, Esq.	4·38	·90	7	24	72·0	12	40·0	20
Sedgebrooke	C. A. Markham, Esq.	4·56	·98	7	24	76·0	11 & 19	33·0	21 & 22
Kettering	J. Wallis, Esq.	4·87	1·00	7	28	70·0	7	37·0	21
Althorpe	W. F. Jakeman, Esq.	4·30	·98	7	21	71·0	12	35·0	5 & 21
Northampton	H. Terry, Esq.	4·06	·92	7	22	72·0	12	36·0	20
RUTLAND.									
Burley-on-the-Hill	W. Temple, Esq.	4·26	·88	9	26	75·0	12	30·0	21
Tickencote	W. Hayes, Esq.	4·34	·80	8	21	66·0	12	38·0	4
West Deyne, Uppingham	Rev. G. H. Mullins	5·15	1·35	7	23	71·3	6	34·6	21
Spital Cemetery, Carlisle	T. Bell, Esq.	2·40	·40	7	20	71·8	6 & 12	33·6	20
Ventnor Hospital	H. Sagar, Esq.	2·60	·69	28	15	67·2	31	42·2	21
Altarnun Vicarage	Rev. G. Tripp	7·80	1·28	15	24	70·0	19	34·0	5 & 21

There is no doubt that the month was one of the wettest, if not *the* wettest May on record in the Midland Counties. Observations going back more than forty years show nothing to surpass it, although an approach is made by the May of 1869, which, we may hopefully note, was followed by a very dry summer. At every Midland station, however, the rainfall of May, 1878, may be taken as from two to three times the average amount for that month. At many points on the west and south-west, the 10th was the day of maximum fall, but in the centre and east most fell on the 7th and 8th. Owing to the superabundance of moisture, the foliage and grass are unusually forward, luxuriant, and green; but wheat begins to suffer, garden seeds have decayed in the ground, and slugs and grubs are very abundant. Bees, however, have had a bad time of it. The barometer has been low and fluctuating; temperature equable, with hardly any frost, but little sunshine and south-westerly winds. Thunderstorms have been frequent, those on the 1st, 13th, 17th, 18th, and 27th may be specially noted. The Swift was seen at Tamworth on the 4th, Kibworth on the 5th, and Castle Ashby on the 15th. Corncrake heard at Burton on 1st, and Castle Ashby on 4th; also, at last place, White-throat on same day. Horse-chestnut flowered at Stroud on 5th, at Burton on 3rd; Hawthorn and Laburnum came out about the 7th, but the show of each has been brief and poor.

Correspondence.

White Ragged Robin *(Lychnis Flos-cuculi.)*—Allow me to record that I have this day found a pure white form of this plant.—S.

Chelidonium majus.—Whilst on a visit to a village on the borders of Notts last year, one of the party said he remembered the spot in a lane where a plant of *Chelidonium majus* grew when he was last there thirty-eight years before. On going to the spot to our surprise we saw a plant of the same kind. Is it not rather curious that the habitat had not been destroyed during the course of so many years?—H. Johnson.

Freshwater Aquarium.—I should feel much obliged for detailed directions how to maintain a freshwater aquarium in good condition. Is it possible to keep alive for any length of time such beautiful and interesting creatures as the freshwater polyzoa, melicerta, conochilus, &c.? If so, how?—M. Beete.

Cuckoo.—A few evenings ago, as I was standing in the garden listening to the Cuckoo, one bird very much astonished me, by several times singing "Cuck-cuck-cuck-cuck-cuck-cuck-coo," repeating the first note, as near as I could count, half a dozen times, but it may have been oftener. Is this a common variation of the bird's usually almost monotonous song? To me it seemed a clear case of "too many 'cucks.'"—N.

Redpoll.—Can any of your ornithological readers tell me what bird is distinguished by the above name? I find, on referring to the "Wild Birds' Protection Act, 1872," that the "Redpoll" is mentioned in the schedule. Would it be considered that under this name is included the brown linnet, which some early ornithologists have, I believe in error, called the "Greater Redpoll?" I shall also be glad to have an opinion as to the correctness of that term, "Greater Redpoll." Is the brown linnet known by that name now? If so, would it be covered by the term "Redpoll," or is that name so generally applied to a particular species as to preclude such an extended signification being given to it?—Fred. W. Rothera.

Glacial Drift Deposits.—I was present at the Annual Meeting of the Union, and was sorry to see so much time frittered away against the good sense of the majority in discussing whether the obviously inadequate subscription of one penny annually per member should be increased to a sufficient sum for carrying on real work by the Union; while one of the most important subjects brought before the meeting, namely, Mr. Harrison's excellent suggestion, that the Societies should one and all take up and investigate, under proper regulations, the subject of the glacial drift deposits of the Midlands, was barely glanced at. Will Mr. Harrison be kind enough, in an early number, to point out what he recommends the Societies to do?—F. L., Shrewsbury.

Thirlmere.—Naturalists and lovers of the picturesque must be grateful to the House of Lords for rejecting the Bill for the alteration of Thirlmere by the Manchester Corporation, although, doubtless, another and stronger attempt will be made next year to force the Bill through both Houses of Parliament. If so, I think some strong protest should be made against the proposed scheme by all Natural History Societies. If the scheme be carried out, *Juncus filiformis* will be destroyed in one of its few English localities, and the most secluded, yet accessible, of our "hunting grounds" must be damaged most materially, not to mention other and more powerful objections against an unnecessary destruction of the peculiar charms of a district round which so many pleasant memories are entwined.—G. C. Druce.

Entomology.—I have often wondered how it is that so little space is devoted in the "Midland Naturalist" to Entomology. Botany seems the favourite science, but surely there are many points in Entomology which require elucidation, and I should think there must be, in various parts of the Midland Counties, original observers who have something to tell about the habits and peculiarities of insects of all kinds, which have not yet been recorded.—M. T. L., Leicester.

Death's Head Moth and the Spindle Tree.—On August 6th, 1877, whilst seated on the tail board of a pleasure van driving through a most lovely lane leading to the ancient "Friends' Meeting House," at Jordan's Wood, Buckinghamshire, (where the philanthropist, Wm. Penn, is buried,) I noticed a large larva feeding upon a shrub in the hedge. Jumping from the van, I soon gained possession of it, a most beautifully marked larva of the Death's Head Moth, *(Acherontia Atropos.)* The plant I had never seen before, so brought a good supply home with me, and though I enquired at the British Museum no one could tell me the name, and by a strange coincidence Mr. Fred Smith (of the British Museum) had a larva feeding upon the same plant, the name of which he had been unable to obtain. I set some of the twigs in my garden, and was much pleased to find it growing, and throwing out vigorous shoots and flower buds, which opened just in time for me to take down to Birmingham to show my old friend Mr. J. E. Bagnall; he at once recognized it as the the Spindle Tree, *(Euonymus Europæus.)* I shall be glad to know if other entomologists have noticed *Atropos* feeding upon this rare plant.—Fred. Enock, 30, Russell Road, London, N.

Organised Work for Scientific Societies.—Your correspondent F. T. L.'s suggestion is one which, it seems to me, should commend itself to the attention of all scientific societies which profess to have any regard for the working out of the Natural History of the districts in which they happen to be situated. Committees might be formed in each society, consisting of those who were prepared, and were deemed competent, to take part in the work. This would enable the workers in each department of science respectively to become acquainted, and to make arrangements as to the areas and the sub-divisions of the work which they preferred to undertake. It would also enable workers to arrive at more satisfactory conclusions. In Geology—for that is the only

subject on which I will venture to speak—good sections, sometimes of more than local interest, such as the junctions between formations, are often lost to science for want of the necessary funds to have them photographed while they are fresh, or before they become grass-grown. When original observations are made, and perhaps local discoveries—which, of course, can scarcely be hoped to happen at very short intervals—the results are communicated to the local scientific society, and beyond a necessarily brief newspaper notice they seldom find their way into print, and are soon beyond the reach of reference. Geology, above all subjects, has to depend so much on artificial openings being made in the rocks that vigilant observers, who will be ready at all times, and often at no little personal inconvenience, to take advantage of any artificial exposures that may be made, are needed in every district. Of course very much of the value of such scientific work as is proposed depends on its thoroughness. Mere flimsy, or "kid glove," observers, who seem to imagine that the more ground they can contrive to cover, no matter how imperfectly, the greater their achievements, should be as far as possible avoided.—J. S.

Gleanings.

A Sturgeon, 8ft. long and 230lbs. in weight, was recently caught in the Estuary of the Severn. This magnificent specimen has been purchased by Mr. Montagu Browne, Naturalist, Birmingham. We understand he purposes mounting it and presenting it to the Birmingham Aquarium.

Geological.—Readers of Mr. J. Shipman's paper in the "Midland Naturalist" for January and February last, entitled "Some new Features in the Geology of East Nottingham," in which several important errors in the geological map of the survey were pointed out, will, we feel sure, be glad to learn that Mr. Aveline, the district surveyor of the geological survey, has very recently gone over the ground examined by Mr. Shipman, and will shortly issue a corrected map and memoir of this district.

The Colouring Matter in the Plumage of Birds.—Mr. H. C. Sorby, F.R.S., recently delivered a lecture on this subject before the Selby Naturalists' Society. He commenced by explaining the cause of colour in general, stating it to be due to the absorption of some of the prismatic colours and the reflection of others. White is produced when all the colours are reflected and none absorbed, whilst black is the result when all are absorbed and none reflected. The colours of feathers are due, first, to the presence of a colouring matter called pigment, which may be extracted and used as a paint; second, to the reflection of the prismatic colours of light by the peculiar construction of the laminæ in the structure of the feathers. Feathers of the first kind are those which show the same colour both by reflected and by transmitted light. The lecturer exhibited a number of water-colour drawings, painted with the pigments extracted from feathers, and observed that in one instance copper was found to be one of the elements in the composition of the colour, which is, perhaps, the only case known in the animal kingdom where copper forms part of the normal structure. A connection had been observed between birds having bright coloured plumage and the flowers on plants on which they feed, the colour of the flowers apparently being developed in the feathers of the birds, especially in the yellow colour, whilst birds of prey were usually devoid of yellow colouring. Grey was shown to be diluted black pigment. The second kind of colours are those which, like the iridescence of a soap bubble are caused by the reflection of light from two surfaces nearly parallel; examples of this kind are found in the feathers of the peacock, pheasant, humming bird, &c., the colours not being caused by pigment, but due to a curious optical phenomenon.

Paris Exhibition.—*Nature* says, "We learn, with pleasure, that at a meeting held at Barrow-in-Furness, on June 3, the Committee of the Naturalists' Field Club belonging to that town determined to organise a scheme for sending representatives (artisans, if possible) to the Paris Exhibition, with the view of collecting information in connection with the various branches of science which are there practically illustrated, one of the conditions being that the result of the observations should be imparted to the club in the form of lectures during the ensuing winter. Promises of substantial support have been received from several of the leading men in the district, and the scheme is expected to be shortly in working order.

Tame-bred Mallards.—Mr. W. H. Roach says in the *Field*:—"I reside between two and three miles from the Liverpool Exchange, so you may guess my place is not very secluded. About ten years ago I brought from Ireland nine or ten wild ducklings that had been hatched by a hen, turned them out on the pond in our garden, never interfered with their wings, but fed them regularly. They remained on the pond, (70ft. by 40ft.) quite tame, and used to come to the hall door for food. However, in the course of time and occasional rambles, they all got shot or otherwise put an end to, with the exception of one mallard, and he for several years past has left me at Christmas, goes I don't know where, but returns as certainly the last week in May, and as tame as ever, taking bread almost from my hand. I have met no one acquainted with a similar case."

Crusade against Sparrows.—From the *Toronto Leader* we learn that the English Sparrow is no longer a favourite in some parts of America. The Nuttal Ornithological Club, of Cambridge, Massachusetts, has made the bird the subject of grave deliberation, and having duly weighed the evidence pro and con. have decided that it ought to be exterminated. It is alleged that the native birds are driven away wherever the sparrow has gained an ascendancy.

Microscopy.—Mr. Dudgeon makes the following suggestion as to examination of small organisms in water:—"Inclose the objective in a brass or other metal tube, having its lower end closed by a piece of thin microscopic glass, coming close up to but not touching the object glass. With this protection we can plunge the end of the microscope into a small tank, filled with water, containing the small livings organisms, and examine them at leisure."

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—Biological Section.—May 14th.—Dr. Rickards read a valuable paper "On the Ear in Man and other Vertebrates," in which he pointed out that, as a descent was made in the scale of vertebrates, the external and middle ears differed in important particulars. In referring to the functions of different parts of the internal ear, he ascribed to the cochlea that of estimating the quality of sound, and declared himself a believer in the view warmly advocated by Professer Crum-Brown that the semicircular canals were the organs of a special sense apart from that of hearing, viz., the sense of rotation. Dr. Rickards expressed the opinion that important light would some day be thrown on the functions of the different parts of the internal ear in man by a comparative study of the anatomy of the organ of hearing in vertebrates in connection with their varying hearing powers. The paper was illustrated by excellent diagrams and wax models, as well as by a fine collection of specimens, amongst which some lent by Mr. W. R. Hughes were

considered by the author to be unique.—Mr. Lawson Tait made some interesting observations on the varying powers of perception of sounds in different persons, and in regard to the organs of hearing in lower animals remarked that, though he had seen many cases of total deafness in cats, he had never found this to be accompanied by muteness.—Among specimens contributed by members of the section the following may be mentioned:—Mr. Blatch described a very rare beetle, *Miscodera arctica*, from Hednesford, and exhibited both the male and female, the species never having been hitherto recorded further south than Yorkshire; Mr. J. Bagnall various rare plants from Warwickshire habitats; Miss Hadley specimens of *Bellis perennis*, showing phyllody of various parts of the flower; Mr. Slatter the male, exceedingly rare, of *Conochilus volvox*. May 21st.—General Meeting.—Mr. J. Bagnall exhibited *Ophioglossum vulgatum*, from Hamstead; Mr. T. J. Slatter exhibited *Achlya prolifera* on the dead larva of a gnat—a microscopic fungus; also, *Ulva crispa*, (Confervoid Alga,) both from Redditch. Mr. A. W. Wills read his third and concluding paper of the series on "Freshwater Algæ." June 4th.—General Meeting.—Mr. J. Bagnall exhibited *Carex fulva*, from Sutton Park; *Poterium muricatum* and *Alopecurus agrestis*, from near Marston Green; Mr. H. E. Forrest exhibited *Alcyonella fungosa*, (Polyzoa,) from Sutton Park; Mr. J. Morley exhibited *Alchemilla alpina*; Mr. M. Browne exhibited nine species of Papilionidæ, including the rare *Papilio zalmoxis*, from West Africa, (unknown three years ago;) Mr. Bolton exhibited Embryo of the Roach, *(Cyprinus rutilus.)* June 11th.—Biological Section.—Mr. W. R. Hughes presented, on behalf of Mr P. H. Gosse, F.R.S., the papers reprinted from Philosophical Transactions "on the Structure, Functions, and Homologies of the Manducatory Organs in the class Rotifera," and "On the Diœcious Character of the Rotifera." The following specimens were exhibited:—By Mr. Montagu Browne, a white variety of common Starling, *(Sturnus vulgaris,)* from Hamstead. By Mr. J. Bagnall, *Polystichum angulare*, from Rowington; *Sanicula Europæa*, and other plants, from Fillongley, &c. By Mr. C. E. Crick, *Aquilegia vulgaris*, *Cynoglossum vulgare*, and other plants, from Llangollen. By Mr. W. Southall, *Equisetum arvense*, *E. limosum*, *E. palustre*, and *E. Telmateia*, all from one pool at Edgbaston, in which they occupy distinct situations corresponding to the different aspects of its various parts. By Mr. A. W. Wills, the very rare Rotifer, *Melicerta pilula*, (Cubitt,) more correctly *Œcistes pilula*, first observed by Mr. J. G. Tatem in 1868, and subsequently named and described by Mr. C. Cubitt in 1872. The peculiarity of the species is its mode of building up its theca from its own excreta, and Mr. Wills exhibited specimens in which, by feeding the animal on alternate days with carmine and indigo; he had obtained tubes built of alternate courses of red and blue bricks. In referring to this Rotifer, Mr. T. Bolton showed drawings of a tube-building Rotifer, probably another species of the same genus, recently described as a new one at a meeting of the Royal Microscopical Society, but which he thought to be identical with one sketched by a friend some years ago, and provisionally named *Œ Anacharis*. In consequence of an unavoidable engagement Mr. W. R. Hughes, F.L.S., was obliged to postpone his paper on *Hippocampus brevirostris*. June 18th.—General Meeting.—Mr. J. Bagnall exhibited *Geranium Columbinum*, *Onobrychis sativa*, *Galium tricorne*, *Helminthia echioides*, *Carex acuta*, and a number of other plants, found between Binton and Stratford-upon-Avon. A number of plants were also exhibited by Mr. J. Butterfield. Mr. W. R. Hughes, F.L.S., read, on behalf of Dr. Spencer Cobbold, F.R.S., a continuation of his valuable communications on "The Parasites of Man," which will appear in the "Midland Naturalist" for August. The paper was illustrated by numerous remarkable microscopic preparations.

BURTON-UPON-TRENT NATURAL HISTORY AND ARCHÆOLOGICAL SOCIETY.—The first excursion made by the members this year took place on May 22nd, and was to Bardon Hill, under the leadership of Mr. W. Molyneux, F.G.S. The granite quarries were first visited and the processes of quarrying, &c., inspected. A good general notion of the geology of the district was obtained. The party next made for the top of Bardon Hill, and enjoyed the glorious landscapes visible therefrom. After collecting numbers of geological and other specimens, the monastery of St. Bernard was visited. After tea at the Forest Rock Hotel, the party returned by train to Burton.

CHELTENHAM NATURAL SCIENCE SOCIETY.—The first session was brought to a successful close on May 16th, when the President, Dr. T. Wright, F.G.S., F.R.S.E., delivered a most instructive address on "Fossil Fishes," for an abstract of which we regret to say we have no room this month.—The Rev. W. S. Symonds and Mr. Francis Day also delivered addresses of much interest, the former discussing the question whether the older fishes lived in freshwater lakes or in salt water seas; and the latter dealing with the subject of "Classification." The next meeting of the Society will be in the autumn.

EVESHAM FIELD NATURALISTS' CLUB.—May 30th.—Mr. J. S. Slater in the chair. It was reported that the Excursion to Mickleton, arranged for May 11th, had, after several times being postponed on account of bad weather, been abandoned for this season. A vote of thanks was passed to Mr. T. Latham for his courtesy on the occasion of the Excursion to Dudley, on the 28th May. The following plants were mentioned by Mr. Doeg as having been found lately in the neighbourhood:—*Saxifraga hypnoides*, *Polygonatum officinale*, *Ophrys muscifera*, and *Polypodium Robertianum*. An Excursion took place on Saturday, June 8th, by break, to Tiddesley Wood, near Pershore. There was not a large attendance. The following plants were found:—*Habenaria bifolia*, *Iris fœtidissima*, *Hypericum androsæmum*, and *Viburnum Opulus*. June 13th.—Mr. A. H. Martin in the chair. Mr. Doeg brought a very large specimen of the Lamprey, *(Petromyzon marinus,)* 26½in. long, and weighing 1¾lb., taken in River Avon, near Cropthorne, last week. Mr. Martin showed an egg of the Night-jar. Mr. G. New reported that *Lathyrus Nissolia* and *Lathyrus Aphaca* were both growing in great abundance on the side of the Worcester Road.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.—NATURAL SCIENCE SECTION.—May 11th.—A geological excursion was made to Annesley. Near the station a section of Lower Bunter red sandstone, capped by drift, was examined. The party then visited (by permission of C. Musters, Esq.) an old quarry in the park. Here are several interesting exposures of highly calcareous and cemented drift May 22nd.—ANNUAL MEETING.—The following officers were elected for the year 1878-9:—President, Mr G. B. Rothera; Vice-Presidents: Mr. E. Smith, M.A., Mr. A. H. Scott White, B.Sc., B.A., F.G.S.; Hon. Secretary, Mr. Isaac Mosley; Committee: Rev. G. E. C. Casey, M.A., F.G.S., Messrs. E. Parry, C. J. A. Crawley, B.A., E. Wilson, F.G.S., A. L. Kohn.—May 25th.—Geological excursion to Stanton-on-the Wolds.—June 10th (Whit-Monday.)—A geological excursion (under the guidance of Mr. E. Wilson, F.G.S.) was made to Miller's Dale. The party visited a marble quarry in Tideswell Dale, where the Toadstone is seen resting upon carboniferous limestone. Description of the section and general geological features of the district by Mr. Wilson. The party then visited a quarry in Monsal Dale and other places of interest.

NOTTINGHAM NATURALISTS' SOCIETY.—June 5th.—An ordinary meeting was held, at which various Natural History objects collected during the present year were exhibited.—Afternoon walks were taken every Saturday during the month.

OSWESTRY AND WELSHPOOL NATURALISTS' FIELD CLUB AND ARCHÆOLOGICAL SOCIETY.—Thursday, June 20th, was fixed for the second Excursion of this Club. Meeting at Forden Station the party proceeded first to Munlyn Farm, where there is a large mound, surrounded by a moat, and close by the Severn. Then crossing the river they came to S. Benno's Stone, a large, upright boulder, standing by the roadside. Next they visited the Church at Berriew, (a handsome modern building,) and admired the view of the Rhiw from the bridge in the village. They followed the road up the beautiful Valley of the Rhiw as far as Pontyffrid, and then struck across the hills, past an old camp, to the top of Powys Castle Park, from which there is a magnificent view of Shropshire and Welsh scenery, including Cader Idris, Plynlimmon, the Arans, and the Berwyn range. Thence the road lay through the Park, with its splendid trees, past the Castle, to Welshpool. The day was all that could be desired, and among the plants found we may mention *Inula Helenium*, *Lamium maculatum*, *Habenaria bifolia*, and *Trifolium striatum*.

SEVERN VALLEY NATURALISTS' FIELD CLUB.—The first meeting of the Club this year was held at Great Malvern, the visit lasting from Tuesday to Friday, June 4th to 7th. On the first day visits were made to the quarries and sections of the North Hill. In the evening papers were read by Mr. F. Day, of Cheltenham, on "Fish Life;" and the Rev. W. S. Symonds, of Pendock, on "Some of the historical associations around the Malvern Hills." Wednesday, June 5th, the party, joined by members of the Malvern, Woolhope, and Cotteswold Field Clubs, drove to the Herefordshire Beacon and Eastnor. A walk of seven miles, commencing at Wind's Point, was undertaken under the guidance of Mr. Symonds. The route was by way of the Great Camp and Hermit's Cave to the Camp on Midsummer Hill, thence by the quarry of Greenstone and Diorite in the Holly Bush Pass, by the valley of the white-leaved oak and a series of quarries to the Somers' Arms Inn, Eastnor, from whence the party drove back to Malvern. In the evening Dr. Thos. Wright, F.R.S.E., of Cheltenham, commenced an address on the Palæontology of the Malvern Hills, and Mr. G. W. Hastings described the structure of the hills. On Thursday, June 6th, a visit was first paid to Dr. Grindrod's fine collection of Silurian fossils, &c. Afterwards the party went by train to Stoke Edith, and Mr. Symonds again acting as guide led the way through the Park to Seager Hill, from which there is a fine view of the Woolhope Valley. Mr. Symonds described the remarkable geological features of the district. The quarries at Dormington were next visited. After tea at the Foley Arms, Tarrington, in the room where Sir Roderick Murchison wrote great part of his "Siluria," the party returned to Malvern, where Dr. Wright finished his address on the Palæontology of the district, and Mr. Symonds narrated the weird legend of the "Shadow of the Rugged Stone." On Friday the party dispersed, after a most enjoyable meeting.

WARWICKSHIRE FIELD CLUB.—At a recent meeting, Mr. Andrews read a paper, of which the following is an abstract:—"Many years ago I made a commencement to examine the glacial or drift formation in the neighbourhood of Coventry, and collected a great number of specimens, but I was not able to continue the investigation. Recently, however, I have returned to the subject, and having studied most of the works on the question which have appeared during the last few years, I became convinced that it was quite hopeless to make any systematic examination of these formations without a much better knowledge of the topography of the district than we at present possess. I therefore resolved to make a new survey of the county, or if that were not possible, at least of the whole of the district round the city of Coventry, and the map now shown is the first instalment of the work. The method adopted in making the survey was very simple, viz., by collecting all the published information that I could as to the altitudes that have been measured, such as the various Ordnance bench marks, the levels of the various canals, railways, &c., by using this information as a basis for the survey, and finally by walking over the district, and examining the altitudes by means of an aneroid barometer, and sketching the contour lines on the spot. I have tinted the map with a series of tints in Indian ink, on the principle that if the waters of the ocean were 200 feet above their present level, they would exactly occupy the space covered on the map by the deepest shade, and which is indicated by the figures, 100, 200. If the waters were 300 feet above their present level, they would also occupy the space covered by the next paler shade which is indicated by the figures, 200, 300, and so on. The district covered by my survey, up to the present moment, (December, 1877,) extends from Hinckley on the north, to Harbury Railway Station on the south, and from Branston on the east, to Knowle on the west, and consequently includes about half of Warwickshire." The map is now placed in the Reading Room of the Free Library, Coventry.

EXCHANGE.

Wanted, *Carex stricta*, *Carex endistans*, *Scirpus triqueter*, for rare plants.—G. C. Druce, Northampton.

RECENT DISCOVERIES IN THE GEOLOGY OF SHROPSHIRE.—I.

BY CHARLES CALLAWAY, M.A., D.SC. LOND., F.G.S.

Introduction.

This paper, furnished at the desire of the Editors of this Journal, gives a brief outline of a paper read by me before the Geological Society, in March, 1877, and published in Vol. XXXIII. of the Society's Journal. Its object is to announce the discovery of a new area of Tremadoc and Pre-tremadoc rocks, near the Wrekin, with a fauna mainly composed of new species. Papers will probably be communicated on the quartzites of Shropshire, and on a recently discovered Pre-cambrian volcanic series of great interest and importance, when the rocks have been more completely worked out. Sir R. I. Murchison has described the area under consideration, from the Wrekin on the north-east to the May Hill sandstone at Kenley on the south-west, as composed of strata of Caradoc age, the Wrekin itself being an igneous outburst altering the Caradoc sandstone on its flanks into quartzite.

The Geological Survey has followed Murchison, but has included, under the name of "quartzite," certain sandstones in which I have detected fossils in abundance.

In the Journal of the Geological Society (Vol. X., p. 62,) Messrs. Aveline and Salter describe this area as Caradoc, and Salter gives a list of fossils from (so-called) Lower Caradoc shales at Harnage and Shineton, mixing up Cambrian forms, such as *Olenus*, from Shineton, with Cambro-Silurian genera, such as *Trinucleus*, from Harnage, the shales at Shineton and at Harnage evidently being considered identical.

Salter, in the "Geological Magazine" for 1867, refers to the shales at Shineton, which he there regards as "the top of the Llandeilo Flags proper." The same writer seems, in after years, to have been struck with the incongruous association of Cambrian and Cambro-Silurian forms; for, in "A Catalogue of the Collection of Cambrian and Silurian fossils contained in the Geological Museum of the University of Cambridge," published in 1873, while describing what he supposes to be a *Triarthrus* from Shineton, he suggests, "it is possible that the locality may include some *Tremadoc* beds." With this exception, geologists have regarded the rocks of the area under consideration as of Caradoc age.

I shall endeavour to prove that the shales at Shineton are of Tremadoc age, and that a part of the so-called "quartzite" between the shales and the Wrekin represents the Hollybush Sandstone of Malvern. The true quartzites are probably Pre-cambrian; and the igneous chain of hills, from Lilleshall Hill through the Wrekin, the Lawley, Caer Caradoc, and on to the south-west, are clearly stratified, and underlie unconformably the Cambrian rocks.

Lower Caradoc Rocks.

Mr. Salter noticed at Harnage and on Cound Brook certain shales containing *Trinucleus concentricus*, Eaton, *Beyrichia complicata*, Salt.,

Diplograpsus pristis, His., *Orthis testudinaria*, Dalm., and other Cambro-Silurian fossils; and as these shales are very similar in lithological characters to the shales at Shineton, and have the same general strike, both shales were lumped together by him as Lower Caradoc. This lithological resemblance is evidently the chief cause of the errors of the surveyors. On closer inspection, however, it is seen that the shale at Harnage contains a distinct fauna from the Shineton shales. The most abundant fossils of the Harnage shales, collected near Broomcroft and in the Harnage and Cound-Brook area, are *Trinucleus concentricus*, Eaton, *Beyrichia complicata*, Salt., *Primitia bicornis*, R. Jones, *Orthis testudinaria*, Dalm., *Theca*, several species of Lamellibranchs, *Diplograpsus pristis*, His., and *Favosites fibrosus*, Goldf. These are common Caradoc forms, and it is perfectly clear that the shales containing them are of Caradoc age. In no case are these fossils found in the same beds as those which contain the older fauna presently to be described. It is necessary to call attention to this point, as the Rev. J. D. La Touche, president of the Caradoc Field Club, in his annual address in February last, has suggested some criticism on my conclusions, basing it on a supposed admixture of the older and younger faunas. There are no signs whatever of such admixture. The Tremadoc fauna ends abruptly upwards; the Caradoc fauna ends abruptly downwards; and not a single distinctively Arenig or Llandeilo species has been found in the district.

The Caradoc rocks of this area are much disturbed and faulted, and on Cound-Brook they are inverted, the older resting on the younger at a considerable angle, and, in one or two spots, Shineton shales are strangely wedged in between Harnage shales. Further details may be seen in my published paper (p. 656); but the Caradoc formation in South Shropshire deserves to be the subject of a separate memoir, recent observations having considerably modified some of the conclusions of Aveline and Salter.

The Shineton Shales.

The locality where I first observed these shales is the spot near Shineton marked on the Geological Survey Map with an arrow dipping to the south-east at 50°. The rocks are there exposed in two good sections on the left bank of the stream. It is from these sections that most of the characteristic fossils have been obtained; and I have, therefore, named the formation from this locality.

1.—*Area.*—These shales cover an area extending from near Evenwood, on the south-west, to within a mile of Wellington, on the north-east, a distance of eight miles. Their greatest breadth, from Shineton to Dryton, is about two miles; but where they range towards Wellington it is contracted almost to a point. The area is roughly triangular in shape, the apex of the triangle pointing to the north-east. Its north-west side is bounded by a fault or faults for probably its entire length, various formations from the Hollybush Sandstone to the Trias abutting against the shales. On the south-east side the triangle is covered in by intrusive basaltic rocks for one-third of its distance from the apex, and the remainder by the May Hill Sandstone. The base of the triangular area

is limited by the Hoar Edge Grits, the lowest beds of the Caradoc. I have recently detected the shales in the hollow between the Lawley and Hoar Edge, on the south-east side of Caer Caradoc, and west of the Longmynd, at the base of the Stiper Stones.

2.—*Lithological Characters.*—The Shineton Shales are dark blue, weathering to olive and yellow, the colouring iron-oxide sometimes separating as a stain or film. They are micaceous, thin bedded, soft, and rather fissile. I have rarely had any difficulty in distinguishing them from the Harnage Shales, either *in situ* or in hand specimens.

3.—*Dip and Strike.*—The general strike of the shales is about south-west, agreeing with the direction of the great fault and of the so-called igneous elevations of the district; but towards the south-west end of the area it bends round to the west, corresponding with the strike of the overlying Caradoc. The mean dip of the greater part of the shales is about 30° to the south-east; but in the lower part of the series, where they approach the fault, it becomes higher, then vertical, than dips steeply to the north-west, the evidence pointing towards the existence of an anticlinal. The thickness of the shales is probably not less than 1,500 feet.

4.—*Stratigraphical Position.*—The Shineton Shales underlie the May Hill Sandstone unconformably; they are therefore older than that formation by an interval. They underlie the Caradoc, and are, of course, of greater antiquity. They overlie, probably unconformably, the Hollybush Sandstone. I shall endeavour to show that they are of Tremadoc age.

(a.)—*Evidence from Fossils.*—Most of the Shineton forms are new specifically, and some of the genera are also new. The species which are of geological value are the following:—*Conocoryphe monile*, Salter. *Conocoryphe* proper is distinctive of Lower Cambrian rocks, and this species is truly typical of the genus. *Olenus Salteri*, Callaway, and *O. triarthrus*, Call., new species of a genus which usually characterizes strata of the age of the Lingula Flags. *Agnostus dux*, Call., similar to certain St. David's forms, (Menevian.) *Lingulella Nicholsoni*, Call., resembling *L. lepis*, a Tremadoc species. *Asaphellus Homfrayi*, Salt.; common in the Upper Tremadoc at Portmadoc.

(b.)—*Evidence from Correlation with Rocks in other Localities.*—*Dictyonema beds at Pedwardine.*—Shales identical lithologically with the Shineton Shales, and containing *Lingulella Nicholsoni*, one found at Pedwardine, twenty-five miles to the south-west of Shineton, on the same line of strike. They also contain *Dictyonema sociale*, which has not yet been found at Shineton.

Dictyonema Beds at Malvern.—Overlying the Olenus Shales near White-leaved Oak, are light-coloured shales, similar to the Shineton and Pedwardine beds, and containing two Shineton forms, *Platypeltis Croftii*, Call., and *Conophrys salopiensis*, Call., together with *Dictyonema sociale*, Salt.

A comparison of the three formations at Shineton, Pedwardine, and Malvern is very interesting. The Shineton beds are connected with the

Pedwardine shales by lithological resemblance, stratigraphical position, and the occurrence of *Lingulella Nicholsoni*. The Pedwardine rocks are correlated with the Malvern *Dictyonema* shales by lithological resemblance, stratigraphical position, and the link of *Dictyonema sociale*. The Shineton Shales are *directly* connected with the Malvern beds by lithological resemblance, stratigraphical position, and the occurrence of two species of Trilobites in common; and *indirectly* through their correlation with the Pedwardine Shales. I think I may fairly conclude that the *Dictyonema* beds at Pedwardine and Malvern are representatives of the Shineton Shales.

The occurrence of *Dictyonema sociale* in the Shineton Shales at Pedwardine and Malvern furnishes another link in the chain of palæontological evidence. This species is common at the base of the Lower Tremadoc of North Wales, and helps to connect that formation with the Shineton Shales. Taken by itself, the occurrence of a single species may not be decisive; but, when other lines of evidence converge to the same point, this fact is of value.

The Black Shales of Malvern are correlated by their fossils with the Dolgelly group, the uppermost zone of the Lingula Flags.

It may be concluded from a review of the evidence that the Shineton Shales are at least as old as the Lower Tremadoc.

The Hollybush Sandstone.

Forming a continuous band between the Shineton Shales and the quartzite which rests upon the Wrekin, is a series of thin-bedded, micaceous, green sandstones, holding the same geographical relation to the Shineton Shales as the Hollybush Sandstone of Malvern holds to the black *Olenus* Shales. The identification of this rock with the Hollybush is placed beyond doubt by the further evidence of *Kutorgina cingulata* and *Serpulites fistula*, which occur in good preservation at Neves Castle, at the south-west end of the Wrekin. The sandstone is also found at Lilleshall, five miles to the north-east of the Wrekin, where it forms an inlier a mile long by a quarter of a mile wide. Since the reading of my paper I have also discovered it on the south-east flank of Caer Caradoc, near Church Stretton. It is well exposed in a quarry at the north-east end of the hill, and contains a thin band of limestone with *Kutorgina cingulata*, *Serpulites fistula*, and other fossils, and holds its normal place betwen the quartzite and the Shineton Shales.

Details of the Hollybush Sandstone as well as of the Shales will be found in my published paper.

Fauna.

I append a list of the Upper Cambrian fossils found in South Shropshire, most of which it will be seen are new to science. They are described and figured in my paper:—

Crustacea.

Asaphus (Asaphellus) Homfrayi, *Salt*. Shineton Shales.
Asaphus (Platypeltis) Croftii, *Call.*, gen. et sp. Shineton Shales.
Agnostus dux, *Call*. Shineton Shales.
Conocoryphe monile, *Salt*. Shineton Shales.

Olenus Salteri, *Call.* Shineton Shales.
—— triarthrus, *Call.* Shineton Shales.
Conophrys salopiensis, *Call.*, gen. et sp. Shineton Shales.
Lichapyge cuspidata, *Call.*, gen. et sp. Shineton Shales.
Primitia, sp. (more than one.) Shineton Shales.

ANNELIDA.

Serpulites fistula, *Holl.* Hollybush Sandstone.

PTEROPODA.

Theca lineata, *Call.* Shineton Shales.

HETEROPODA.

Bellerophon shinetonensis, *Call.* Shineton Shales.

BRACHIOPODA.

Lingulella Nicholsoni, *Call.* Shineton Shales.
Obolella sabrinæ, *Call.* Shineton Shales.
Kutorgina cingulata, *Bill.* Hollybush Sandstone.

ECHINODERMATA.

Macrocystella Mariæ, *Call.*, gen. et sp. Shineton Shales.

HYDROZOA.

Dictyonema sociale, *Salt.* Shineton Shales.
Dendrograptus. Shineton Shales.

PARASITES OF MAN.*

BY T. SPENCER COBBOLD, M.D., F.R.S., HON. VICE-PRESIDENT OF THE BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.

[*Continued from page 121.*]

Although the twenty-four parasites already brought under the notice of the Section may be fairly regarded as exhausting the list of human trematodes and cestodes, yet several other species of tapeworm have from time to time been indicated on what are probably insufficient grounds. In this doubtful category I place Weinland's *Tænia megaloon*, and also another tapeworm which Dr. Ransome concludes to exist from the diagnostic evidence furnished by the finding and examination of a particular form of cestode ovum. In Weinland's case both loose proglottides and eggs were examined; consequently the strobile may turn out to represent a good species. Weinland figures the ova (in *Zoolog. Garten Frankf., 1861, s. 118.)* Respecting a variety of manifestly spurious entozoa, such as Frèdault's *Trachelocampula* and the like, I have nothing to say.

* Read before the Microscopical Section of the Birmingham Natural History and Microscopical Society, June 18th, 1878. On Dr. Cobbold's behalf, Mr. Hughes exhibited examples of *Trichina spiralis*, both in the sexually mature and larval states (capsuled and free.) He also showed specimens of *Trichocephalus dispar* and *T. affinis*, together with their ova. As regards hæmatozoa, specimens from human blood, and also from the dog. were shown in contrast, from slides prepared and presented by Dr. Lewis, of Calcutta. A full-grown example of *Filaria Bancrofti* and numerous larvæ were also exhibited. These were from Australia.

The nematoid group of parasites, next to be considered, are probably better known than any other helminths. This arises partly on account of the excessive frequency of the little threadworm, *(Oxyuris,)* partly from the circumstance that the large round worm *(Ascaris)* bears a marked resemblance to the common lob-worm of our gardens, *(Lumbricus,)* and partly, or perhaps chiefly, because the spiral flesh-worm *(Trichina)* plays an important *rôle* in the production of epidemic disease *(Trichinosis.)* Endless mistakes have arisen from the error of confounding parasitic roundworms with earthworms. The mischievous character of unscientific or inexact knowledge may be illustrated by the fact that I have known nervous persons so seriously alarmed at the appearance of lumbricoid entozoa that they have regarded their presence as an omen of approaching dissolution. I have even known a spurious nematoid to be dreaded as "the worm that dieth not." It is very important that correct views should be entertained respecting the nature and sources of the various members of this group of parasites. Nothing is more absurd than the popular notion that nematoid entozoa, especially threadworms, *(Oxyurides,)* arise or make their appearance in consequence of an impoverished state or cachexia of the body of the host. This ridiculous conception, which is as old as the hills, is ever and anon re-asserted with all the pride and confidence which should only be displayed when any real and valuable discovery has to be announced. The notion, as it now stands, is a feeble remnant of the theory of equivocal generation. For the establishment of the truth of this theory the spontaneous generationists always pointed, triumphantly as they supposed, to the mode of origination of the entozoa. The truth is, neither threadworms nor helminths of any other kind arise from diseased conditions. They often produce constitutional disturbance in their victims, this bad effect being misinterpreted as a cause of the appearance of the entozoa themselves. A healthy person is just as likely—nay, he is even more likely to entertain parasites than a feeble person. True, the strong host may suffer comparatively little, whilst the weak host succumbs to his guests. The host is the entozoon's native territory. What our native island is to us, our bodies are to parasites. To attack, to invade, to infest, is their legitimate prerogative; and for this end it must be admitted that their organisation is admirably adapted. To be sure, it is equally our prerogative to refuse the would-be guests admission, but any method of resistance likely to prove effectual must be based upon scientific conclusions resulting for the most part from experimental research. Ancient dogmas and preconceived opinions too often operate to obscure the mental vision, and thus prevent the adoption of measures calculated to check not a few of the many evils to which our common flesh is heir.

NEMATODA.

25.—*Trichina spiralis*, Owen.

Synonymy.—*Pseudalius trichina*, Davaine.

Larvæ.—Commonly spoken of as muscle-trichinæ, capsuled or encysted trichinæ, and fleshworms.

Intermediate Host.—All warm-blooded animals, especially mammals, and of these the hog and rat more especially. Man himself may become an intermediate bearer.

Experiments.—These are of two kinds, as referring either to the larvæ or to the full-grown worm. The larvæ were first reared by Herbst (1850) and the adult worms by Virchow (1859.) These results were subsequently verified and extended by Leuckart, Claus, Küchenmeister, Pagenstecher, and many others abroad; and they were confirmed by Thudichum and myself in this country. The worm-feedings administered by Prof. Simonds and myself infected four dogs, two cats, one pig, one guinea pig, one hedgehog, and probably several rats which, unfortunately, made their escape.

Remarks.—The original discovery of the capsules, as "little bodies" or "concretions," was made either by Tiedemann, (1822,) or by Peacock (1828.) Their parasitic character was first indicated by Hilton (1833.) The actual discovery of the worm was first made by Paget, (1834,) and afterwards scientifically named and described by Owen (1835.) The most brilliant discovery of all was that of Zenker (1860.) He it was who demonstrated that migrating Trichinæ were productive of disease (Trichinosis.) Finally, the most complete account of the migrations and structural changes undergone by the worm are due to Leuckart.

Literature.—Althaus, Essay on Trichinosis, 1864; Boehler, Die Trichinenkrankheit in Plauen, 1863; Gerlach, Die Trichinen, 1866; Cobbold, On the History of the Discovery of *Trichina spiralis* in Supp. to "Entozoa," 1869; *Idem*, Experiments, Proceedings Linn. Soc., 1867; Leuckart, Untersuchungen ueber *T. spiralis*, 1866; Luschka, Zeitschrift für Wissensch. Zool., 1851; Owen, in Zool. Soc. Trans. 1835; Pagenstecher (and Fuchs,) Die Trichinen, 1865; Thudichum, Government Report "On Parasitic Diseases," &c., 1865; Virchow, Darstellung der Lehre von den Trichinen (u. s. w.,) 1864; Zenker, Zur Lehre von der Trichinenkrankheit, in Deutsches Archiv f. Klin. Med., Bd. VIII., and in Virchow's Archiv., 1855.

26.—*Trichocephalus dispar*, Rudolphi.

Syn.—*T. hominis*, Goeze; *Trichuris*, Buttner; *Ascaris trichiura*, Linn.

Larvæ.—Küchenmeister and Meissner supposed that Trichinæ were the young of Trichocephalus. This view was controverted by Virchow.

Int. Host.—Unknown. The experiments of Davaine render it probable that infection takes place in a direct manner some time after the eggs have escaped the human bearer.

Experiments.—Davaine finds that dryness does not destroy the ova, and that a period of six months elapses before embryonic formation commences. The embryos will live for many years in the freed eggs.

Remarks.—The Dublin helminthologist, Bellingham, was one of the earliest to attest the frequency of the whipworm in Great Britain. He found it in eighty-one out of ninety *post mortem* examinations. Davaine has stated that not less than half the Parisians are victimised by this worm. Mr. Cooper, of Greenwich, found it present in eleven out of sixteen autopsies. Either this worm or its congener (infesting ruminants) has been anatomised by Dujardin, von Siebold, Mayer, Eberth, Erasmus Wilson, Busk, Bastian, and myself.

Lit.—Bastian, in Philos. Trans., 1866; Bellingham, in Dublin Journal, 1838; Busk, in Annals Nat. Hist., 1841; Cobbold, in

Linn. Trans., 1859; Eberth, in Sieb., and Köll, Zeitschr., 1860; Mayer, *ibid*, 1858-60; Siebold, in Wiegm. Archiv., 1845; Wilson, E., in The Veterinary Record and Transactions, 1846.

27.—*Filaria Bancrofti*, Cobbold.

Syn.—*Filaria sanguinis hominis*, Lewis; *F. Wüchereri*, Cobbold, (conditionally;) *Filariose dermathemica*, O'Neill; *Filaris sanguinis*, Bancroft; *Trichina cystica*, Salisbury.

Larvæ.—The synonyms above given all originally referred to the embryonic condition; but the embryos have also been described as nematoid hæmatozoa, micro-filariæ, hæmato-chylous helminths, (Corre,) worms of Guadeloupe, (Crevaux,) worms of Brazil, (Wücherer,) probably embryos of Stronglidæ, Leuckart,) anguillula-like microscopic nematodes (Sonsino.)

Int. Host.—Dr. Bancroft originally suggested and Dr. Manson actually discovered that the hæmatozoal micro-filariæ were passively transferred to the stomach of mosquitoes. Dr. Manson has described the transformations undergone by the larvæ within these insects.

Experiments.—Dr. Manson induced an infected Chinese to sleep in a mosquito-house, and thus procured on the following morning a number of mosquitoes that had gorged themselves with blood containing human filariæ. A relatively far greater proportion of hæmatozoa existed in a drop of the insucked blood taken from the mosquito than in a drop taken from the Chinese in a direct manner. The construction of the proboscis of the female mosquito seems to be especially adapted for drawing the worms out of the capillary bloodvessels.

Remarks.—There is every reason to believe that the microscopic hæmatozoa of man are capable of producing a variety of diseases, some of which are endemic. In this category must be placed certain forms of hæmaturia, chyluria, varix, elephantiasis, and other lymphoid affections, and likewise the African cutaneous disorder termed craw-craw. The whole of them have been characterised as constituting varieties of one disorder which Dr. Bourel-Roncière terms Wücherer's helminthiasis. The adult worm was first discovered by Bancroft and first described by myself. It was afterwards found and described by Lewis, and subsequently our "finds" were verified by Dr. Araujo and by Dr. F. dos Santos. The larvæ were first discovered by Wücherer, whose observations were afterwards verified and extended by Salisbury, by myself, and especially by Lewis. Free microscopic nematoids very closely resembling these larvæ have been found in the potable waters of Rio (aqua da Carioca) by Dr. Magalhaes. Their genetic relation with *F. Bancrofti*, however, is very doubtful.

Lit.—Wücherer, in Gaz. Med. da Bahia, Dec., 1868, and Sept., 1869, and in Hallier's Zeitschrift, 1869, and in Arch. de Méd. Navale, 1870; Salisbury, in Hay's Amer. Journ., 1868; Cobbold, in Brit. Med. Journ., July, 1872, and in Lectures on Helminth., 1872; in B. M. J., June, 1876; in the Lancet for July and Oct., 1877; in Reports of the Proceedings of the Linnean Soc.; of the Pathological Soc.; of the Medical Society of London; in the Lancet for March; in Nature of the same month, and in the Popular Science Review for April, 1878; Leuckart, Die Mensch. Par. Bd. II., 1876; Corré, Rev. des Sci. Nat., Sept., 1872; Crevaux, De l'hématurie chyleuse, &c., Paris, 1872; Silva-Lima (with Crevaux,) Mem. sobre a hematuria chylosa ou gordurosa, (Bahia,

1876,) and in Gaz. Med. da Bahia, Sept., 1877, and in the Lancet for March, 1878; Foncervines, in Robin's Léçons, 1875; Lewis, on a hæmatozoon in human blood, in Gov. Rep. for 1872, and separately (Calcutta 1874,) in Indian Annals, 1873, in Med. Press, 1873, in Lond. Med. Record (rep. by me,) 1873, in Nature, 1873, and in his memoir on the Path. significance of the nematode hæmatozoa, Calcutta, 1874; see also Lewis's recent "Remarks regarding the Hæmatozoa found in the stomach of Culex Mosquito," in Proceed. of the Asiatic Society of Bengal, for March, 1878, (p. 89); Sonsino, Richerche intorno, &c., in Rend. della R. Accad. di Napoli, 1874, and in Arch. Gen. de Méd., June, 1876; Araujo, in Arch. d. Méd. Navale, 1875; Magalhães, P. S. de, in Gaz. M. da Bahia, 1877, and in O Progresso Medico for Dec., 1877; O'Neill, on Craw-craw, in Lancet, Feb., 1875; Bourel-Roncière, in Arch. de Méd. Navale, March, 1878, (see Araujo); Manson, Report on Hæmatozoa, in the 6th part of the Customs Gazette, Shanghae, 1877, and rep. in Med. Times and Gazette, also additional cases in M. T. and G. for March, 1878, also (in a joint communication with me) in rep. of the proceedings of the Med. Soc. of London, in the Lancet, March 30, 1878; Le Roy de Méricourt, in Appendix to Nouvelle phase de la question relative à la nature parasitaire de la chylurie, (Découverte du représentant adulte de la Filaire de Wücherer,) being a translation of Silva Lima's memoir, quoted above, (Arch. de Méd. Navale, Dec., 1877.) See also translations, with additions, in the Veterinarian for Feb., 1878; Araujo, A. J. P. da S., Memoria sobre a Filariose, &c., (Bahia, 1875,) see also Bourel-Roncière's analysis of and commentary upon the writings of Silva Lima and Silva Araujo in the Archives above quoted; Santos, F. dos, in Gaz. Med. da Bahia for March, 1877; Moura, J. de, Thèse de concours, 1877

[TO BE CONTINUED.]

ON THE STUDY OF THE MOSSES.—II.

BY JAMES E. BAGNALL.

(Continued from p. 196.)

Mosses are said to be synoicous when male and female organs occur in the same enveloping leaves, as in *Mnium subglobosum;* monoicous when these organs occur in different buds on the same plant, as in *Hypnum rutabulum;* dioicous when the male organs occur on one plant and the female on another plant of the same species, as in *Ceratodon purpureus*.

The antheridia, (see Plate 4, fig. 7 *a*.,)* are sac- or sausage-shaped bodies, and are usually surrounded by a number of thread-like jointed bodies, called the paraphyses, (7 *b*,) (Gr. *para* beside, and *phuo* I grow.) The function of these bodies is probably that of nutrition. In the Sphagnums these paraphyses are absent, and the antheridia are very differently shaped, consisting of a short stalk, (8 *a*,) surmounted by a globular head, (8 *b*,) the antherozoids being developed in the globular

* All the references in this article are to Plate IV., facing page 193.

head; these antheridia may be readily obtained by carefully dissecting away the leaves of the catkins, which are usually reddish or brown, and often occur near the summit of the stem. If the antheridia of ordinary mosses are examined microscopically with a $\frac{1}{4}$ or $\frac{1}{8}$-inch objective, they will be seen to contain a number of closely packed cellules, and in each of these cellules a spiral thread-like body may be seen. This spiral body is the antherozoid or fertilising principle of the antheridium; and, supposing that the antheridium is ripe, a very slight pressure of the cover glass will cause it to burst at the apex, and the enclosed cellules will be seen swarming out with a sort of jerky motion, (7 *c*.) In a few minutes the cellulose coat of the cellules is dissolved, and the spiral bodies, the antherozoids, thus liberated, commence moving about in the water, much like some infusoria.

This beautiful sight may be seen readily, and the star-like male flowers of Polytrichum are the most easily examined. These should be got about the end of May or in June. The outer leaves of the flowers should be dissected away, and some of the ripe antheridia should be examined in water with the 4-10th or $\frac{1}{4}$-inch objectives.

The archegonia, (9,) (which, with the exception of the Sphagnums, are also surrounded by paraphyses,) are somewhat flask-shaped bodies, the upper part consisting of a slender neck, (9 *a*,) the lower part being somewhat pear-shaped, (9 *b*.) In the centre of the pear-shaped body, and near the top, is a small cavity, within which a nucleated cell is developed, called the germinal vesicle, (9 *c*;) and after the archegonium has acquired some size, a closed canal will be seen passing down the neck, (9 *d*,) into that part of the pear-shaped body in which the germinal vesicle, (9 *c*,) is situated. After a while, as growth goes on, the cells bounding the top of the neck fall away, thus leaving an open passage down the canal to the germ cell. Down this canal the antherozoids pass, and reaching at length the germ cell bring about impregnation.

After impregnation has taken place cell-division commences in the germinal vesicle, and continues until by frequent repetition the fruit rudiment is formed. During this time the archegonium increases in size, the rudiment growing longitudinally, and striking deep down into the base of the archegonium. This continued upward and downward pressure on the delicate tissues of the archegonium causes it to rupture near the base; the upper part being carried upwards by the growing fruit rudiment, (10 *d*,) forms the hood or calyptra, (10 *a*,) the lower part is left surrounding the base of the rudiment and forming a sheath, which is called the vaginula, (10 *c*,) (Lat., a little sheath.) At the top of the fruit rudiment the capsule is formed within which the spores are developed.

By virtue of the insertion of the fruit-stalk mosses are divided into two sections, Acrocarpi, or those mosses which have the fruit-stalk terminating the main stem, (4,) as in *Pottia truncata*, and Pleurocarpi, or those mosses which have the fruit-stalk arising from the side of the stem, (5,) as in *Hypnum rutabulum*.

The fruit-stalk, which is always present, varies in length; in some cases, as in *Phascum serratum*, it is very short, in other cases it may be long and conspicuous; it is usually smooth, but sometimes the surface is

distinctly roughened or granulated as in *Hypnum rutabulum.* It may be straight or variously curved.

The base of the fruit-stalk is surrounded by leaves which in some species differ remarkably in both form and structure from the other leaves of the plant. These are the perichætial leaves, and the character of these leaves often forms a special feature in the description of mosses. If these leaves are carefully removed it will be seen that the base of the fruit-stalk is surrounded by a membranous sheath, the vaginula, (10 *c*,) already mentioned; this is usually smooth, but in some species it is more or less clothed with hair-like processes, and these minute differences are in some cases great aids in the discrimination of nearly allied mosses.

At the top of the fruit-stalk is the capsule or urn, (4 *c*, 5 *b*,) and this organ presents great variety in its form, in some cases globose, *Phascum cuspidatum*; pear shaped, *Leptobryum pyriforme*; cylindrical, *Tortula aloides*; straight, curved, or erect, *Tetraphis pellucida*, (12;) cernuous (curved to one side) as in *Hypnum rutabulum*, (5,) or pendulous as in many of the Bryums; it may be smooth, striated, or furrowed.

In some species the capsule, (14 *b*,) is swollen all round at the base (14 *c*,) and this swollen part is called the apophysis, as in *Splachnum sphæricum*; this apophysis may be seen at the base of the capsules of *Polytrichum commune*, but not so exaggerated as in Splachnum, sometimes the swelling is confined to a little bulging out of one side of the base of the capsule as in *Dicranum falcatum*, (13 *b*,) or in *Dicranella cerviculata* or *Ceratodon purpureus*, &c.; the capsule is then said to be strumose.

The capsule is surmounted by a membranous hood called the calyptra, already mentioned as being developed from the upper portion of the fertilised archegonium, (10*a*, 17, 18.) In some genera, such as the Bryums, this hood falls away early, and hence is not seen upon the mature capsule, but in many other genera, such as Tortula, Hypnum, &c., it is persistent and may readily be seen. In the act of separation from the lower part of the archegonium, or vaginula, the calyptra is sometimes irregularly torn at its base as in *Grimmia apocarpa*, or it may be evenly torn as in *Encalypta vulgaris*. In both cases the calyptra is termed mitriform or mitre-shaped (10 *a*.) In many other mosses it is slit up one side, and is then said to be dimidiate, (Lat., *dimidium*, a half,) (18,) or it may be inflated as in Funaria, (17,) and these characters are constant. Usually the outer surface is smooth, but in some species it is papillose, and in others more or less densely clothed with hairs as in Orthotrichum and Polytrichum.

The mouth of the capsule is closed with a little lid called the operculum, (12 *a*, 13 *a*, 14 *a*,) and between the lid and the mouth of the capsule a ring of minute, highly hygroscopic cells frequently occurs called the annulus, (Lat., a ring.) The function of this ring is that of casting off the lid when the spores are ripened, and thus aiding their dispersion, but in many mosses, such as *Tortula unguiculata*, there is no annulus, and the lid is then cast off by the swelling of the contents of the capsule. The operculum is not always present, and here nature adopts other means to bring about the dispersion of the spores; in the Andreæas or split-mosses, (19,) the capsule splits into four valves, (19 *a*,) and in the Phascums or

earth-mosses the capsule bursts irregularly, or rots away and in its decay liberates the spores.

The lid or operculum varies in form, being sometimes convex, as in many of the Bryums, or conical, (4 *a*, 12 *a*,) as in *Physcomitrium pyriforme*, *Tetraphis pellucida*, &c., or it may be rostrate, (beaked,) (13 *a*,) as in *Dicranella heteromalla*, &c.

When the lid is removed, or has been cast off naturally, the inner structure of the capsule may be seen, and in some mosses, such as *Pottia truncata*, the mouth will be found to be naked, (4 *e*,) but in many other cases it will be seen to be surrounded by a delicate fringe-like appendage, called the peristome, (12 *b*, 21 *b*,) (Gr. *peri* around, and *stoma* a mouth.) This fringe consists of minute tooth-like processes, which are always some multiple of 4 in number, from 4 to 64, and the number is always constant in the species. This fringe may be either single, (12 *b*,) or double, that is there may be an outer, (20 *a*,) and an inner row, (20 *b*,) of these tooth-like processes. The teeth of the peristome vary in form and structure; in some cases, as in certain of the Weissias, they are very rudimentary; in others, as in Funaria, they are elaborately developed, and beautifully marked with transverse and longitudinal striæ or markings. The teeth are often simple, (12 *b*,) but may be cloven, as in *Dicranella heteromalla*, sometimes straight, as in *Didymodon rubellus*, or much twisted, as in *Tortula muralis*, &c. In the Polytrichums the mouth of the capsule is closed by a beautifully reticulated diaphragm, to which the teeth of the peristome are attached, (21 *c*.) This is peculiar to the family of Polytrichaceæ, so far as British mosses are concerned.

The study of the development of mosses is one of very great interest, and worthy of the attention of all biological students. Space is too limited to allow the matter to be dealt with here in anything like fulness, and I must, therefore, refer those students who desire fuller information to that grand work of Hofmeister (Ray Society's publications) on the Germination, Development, and Fructification of the Higher Cryptogamia, pp. 129-181, where a most elaborate and exhaustive account will be found.

ON THE RELATION OF THE CRUST TO THE INTERIOR OF THE EARTH.*

BY FRANCIS D. LONGE, F.G.S.

The interior of the earth is beyond the reach of direct observation, but Nature brings within our limited scope much evidence upon which a general theory may be founded as to the relation between it and the crust. That the earth was once in a fluid state from heat is an essential part of the theory of cosmogony established by Laplace, Newton, Herschell, and others.

* Abstract of a Paper read April 18, 1878, before the Cheltenham Natural Science Society.

This doctrine has for a long time been accepted by geologists as a fundamental principle of their science. Their researches not only corroborate this theory, but supply evidence which, coupled with the results of observation as to movements now going on in the earth's crust, shows that the process of cooling and consolidation is still in operation.

The phenomena of volcanoes would appear to afford direct evidence of the interior of the earth being still in a state of intense heat. In a paper submitted to the Royal Society in 1874, Mr. Robt. Mallet attributed the heat by which volcanic eruptions are produced to the effect of friction resulting from the crushing of solid rocks in the cooled surface. This view had not met with much acceptance; but, as Mr. Mallet accounted for the crushing of the crust by the contraction of the interior in the process of cooling, his theory was not inconsistent with the general theory of a cooling earth.

The undulatory movement of the earth's crust, shown by the elevation and depression of the surface, is conclusive evidence that the interior of the earth is not solid. There is abundant evidence of such movements in former geological periods, and at the present time. In the Malvern area a great part of the older rocks have sunk, and new red deposits have taken their place. At Swindon, in Wiltshire, the quarries disclose the remains of an old land surface, which first sunk and became covered with deposits of the cretaceous sea, and was then re-elevated for the enjoyment of terrestrial beings. The Suffolk coast shows similar movements in recent geological times. Sir C. Lyell, Professor Ramsay, and other authorities testify to similar movements in recent times in Africa, South America, Northern Asia, British Columbia, and the Pacific, and particularly to the elevation of Sweden and the Baltic, now progressing at the rate of $2\frac{1}{2}$ feet in a century.

At a recent meeting of the Geological Society, Captain Fielden, the Naturalist to the recent English North Polar Expedition, stated that at the present time the coasts of Greenland and Grinnell Land are steadily rising from the sea. These movements prove conclusively that the earth is not yet solid. They would be explained, if the earth consisted of a mass of mixed substances, such as we are acquainted with as forming its crust, still for the most part in that viscid or yielding condition, which we know that they assume when passing from the molten to the solid state in cooling, such for instance as lava, glass, iron, basalt, &c.

Can the earth's pristine heat be still retained in it? Assuming that it was once heated, its heat could only escape through the crust. If the crust consisted of absolutely non-conductive materials it would never lose its heat. The crust is not of such a character, but the materials which form its bulk are slow conductors. The escape of heat would become slower as the crust thickened.

Observations of underground temperature show that the heat increases at the rate of one degree Fah. for every 60 feet. This gives a temperature of 2,500 F. at about thirty miles from the surface. At such a temperature lava would be as liquid as water. Pressure may condense

heated matter but cannot convert matter which is in a fluid or viscous state from heat, into a solid. It would retain the moving property of a fluid so long as it retained its heat.

If the behaviour of the internal mass of the earth during the process of cooling was similar to that of lava or basalt,

(1.)—The solidification would commence at the surface.

(2.)—The matter in passing from the liquid or viscous to the solid state would attach itself to the parts already solid, *i.e.*, to the under surface of the already solid crust.

(3.)—The matter in becoming solid from loss of heat would for the most part contract.

(4.)—The process of cooling and solidification would not take place regularly, owing to the difference in temperature at which different substances become solid, and the difference in the conductivity of different parts of the crust overlying the heated matter.

(5.)—The solidified portion or the crust would press on the liquid or viscid interior until it became self-supporting.

(6.)—Gravity would require the several parts of the crust to be in equilibrium. The disturbance of the equilibrium of the crust by irregularity in its growth would be restored by the action of gravity upon it.

The elevation of continents and mountain chains, and the formation of deep oceanic areas and other synclinal depressions, are produced by the long continued action, in a particular direction, of lateral or horizontal pressure or compression resulting from the sinking of the crust on the contracting internal mass on which it rests. The effect of lateral pressure is shown both by the minute plication of laminated strata, as in the cuttings through Lias clay of the new railway between Cheltenham and Banbury, or in the folding of a large expanse of surface as shown by Professor Dana to have been the way in which the Alleghany Mountains were formed. The parallelism of mountain ranges, and of the outcrop or strike of strata in the same area, which results from the action of lateral pressure upon the crust in the same direction, is well illustrated in England.

The change in the movement by which any area which has been previously elevated undergoes depression, or *vice versa*, implies a change in the conditions by which the action of lateral pressure is directed. Such changes are caused by irregularity in the growth of the crust and the consequent disturbance of its equilibrium. Such changes could not be produced by the mere settlement of dead materials into a more compact state. Such a process of consolidation would commence at the centre and progress upwards, and when the interior had once become compact, no undulation of the surface would be possible. With such a condition of the interior the surface of the earth could not be changed. It would be levelled by denudation, and the ocean would spread over the whole. Terrestrial life would cease to exist for want of a footing. A self-supporting crust would be equivalent to a solid earth. The undulatory movement of the crust was greater in early geological periods than now. The Cambrian and Silurian strata comprise deposits of some six miles

in thickness, which were evidently laid in shallow seas. Their great thickness was attained by the rapid and long-continued subsidence of the sea bottom, at a time when the crust was thin, and the contraction of the interior from the radiation of heat was progressing more rapidly than afterwards.

Volcanic phenomena have also changed in respect of the amount of igneous rock erupted, which is much less now than in early geological periods. This change would be the natural result of a thickening of the crust, and the consequently increased distance through which the molten matter has to pass before it reaches the surface.

The question is being much discussed by geologists at the present time, owing to the evidence which recent researches in the Arctic regions have furnished of a temperate or sub-tropical vegetation having flourished there in recent geological periods, which can only be satisfactorily explained by a change in the geographical position of the poles. Such a change would result from the displacement of the axis of figure under the process of cooling referred to in this paper, and its readjustment to the axis of rotation by the rotatory force.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF JUNE, 1878.

BY W. J. HARRISON, F.G.S.

The wet period which caused such an excess of rainfall in May continued until the middle of June. About the 18th of the latter month, however, (Waterloo day,) a welcome change set in. The continuous rains ceased, and the temperature rose steadily until on the 26th and 27th it exceeded 90° at several stations. From one or two places returns of 95° and upwards have reached us, but these can scarcely be true shade temperatures. Unless the thermometers are placed in a clear and open space, at a fair distance from walls, &c., and thoroughly screened by double louvres both from the sun's direct and reflected rays, their indications are not to be relied upon. The solar radiation thermometer (black bulb *in vacuo*) indicated 142° at Leicester, on the 23rd; 141° on the 21st and 26th; and 150° at Spondon, on the 26th.

The effect of the heat and direct sunshine of the last ten or twelve days of June upon the crops was great and immediate. Wheat and barley changed from a sickly yellow to a deep green. The grass crops are very promising, and in the orchards there is every prospect of an abundant crop of apples, pears, and plums.

During this hot period thunderstorms were frequent and violent, and produced heavy falls of rain in a short time. At Stroud 1in. fell in an hour, on the 17th; More Rectory, 1·05in. in 1¼ hours, on the 8th; Larden Hall, ·55 in 1 hour, on 8th; ·42 in 30 minutes, on 23rd; Stokesay, ·77 in 45 minutes, on 8th; Burton, ·24 in 15 minutes, on 26th; Weston-under-Lyziard, ·77 in 45 minutes on 29th; Tamworth, 1·61 in 3 hours, on 29th; Henley-in-Arden, 1·27 in 20 minutes, on 26th; Stuffynwood Hall, ·24 in 30 minutes, on 26th; Sedgebrook, 1·23 in 3 hours, on 26th; Northampton, 1·25 in 50 minutes, on 26th; Bishop's Castle, ·84 in 45 minutes, on 8th; Cheltenham, ·39 in 20 minutes, on 23rd. The importance to engineers and others of a knowledge of these heavy falls of short duration is obvious, as the sewers, watercourses, &c., are often totally inadequate to cope with such emergencies.

Natural History notes are few this month, but from Burton Mr. Tripp reports lime in flower on 6th, and wild rose on 10th.

STATION.	OBSERVER.	RAINFALL.				TEMPERATURE.			
		Total for M.	Greatest fall in 24 hours.		No. of rainy d.	Greatest ht.		Great'st cold.	
		In.	In.	Date.		Deg	Date.	Deg	Date.
GLOUCESTERSHIRE.									
Cainscross, Stroud	W. B. Baker, Esq.	8·51	1·08	17	14			29·9	15
Cheltenham	R. Tyrer, Esq.	2·49	·47	2	15	85·8	26	42·0	6
Stroud	S. J. Coley, Esq.	8·75	·97	17	18	84·0	26	45·0	5 & 8
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	2·57	·58	29	13	83·0	26 & 27	38·0	6
Whitchurch	A. B. George, Esq.	8·95	·98	8	18	85·0	27	42·0	5
Woolstaston	Rev. E. D. Carr	8·92	·70	8 & 11	14	84·5	26 & 27	43·0	1 & 14
Leaton Vicarage, Shrewsbury	Rev. E. V. Pigott	2·91	·78	8	14	88·0	26	35·0	6
More Rectory, Bishop's Castle	Rev. A. Male	8·49	1·06	8	18	84·0	26	37·0	6
Larden Hall, Much Wenlock	Miss F. R. Boughton	4·20	·91	29	15				
Bishop's Castle	E. Griffiths, Esq.	8·65	·84	8	16	86·0	25 & 26	40·0	6
Cardington	Rev. Wm. Elliot	4·18	·78	11	15				
Adderley Rectory	Rev. A. Corbet	8·63	·92	9	17				
Stokesay	Rev. J. D. La Touche	8·92	·80	8	17	86·1	26	41·2	15
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	8·08	·48	10	17			86·0	15
Stoke Bliss	Rev. G. E. Alexander	2·12	·48	11	11	86·0	29	48·0	5
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq.	8·19	·49	11	16	86·0	26	38·0	6
West Malvern	A. H. Hartland, Esq.	2·39	·46	9	14	92·0	26	42·5	5
Pedmore	E. B. Marten, Esq.	2·65	·52	9 & 11	18	89·0	28	48·0	5
Stourbridge	Mr. J. Jeffries	2·89	·49	11	18	90·0	25 & 26	42·0	20
St. John's, Worcester	G. B. Wetherall, Esq.	1·78	·40	8	11	84·0	26 27 28	40·0	1
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	8·85	·69	29	15				
Barlaston	W. Scott, Esq.	8·88	·77	12	15	86·1	26	34·0	5
Amblecote	Mr. J. Robins	2·58	·46	9	12				
Dudley	Mr. J. Fisher	8·89	·61	9	18	94·0	26	42·0	5
Sedgley	Mr. C. Beale	8·01	·49	9	18	88·0	26 & 27	44·0	5
Kinver	Mr. W H. Bolton	2·57	·54	9	12	87·0	26	39·0	5
Walsall	Mr. N. E. Best	8·55	1·21	29	15	85·0	27	44·0	5
Grammar School, Burton	C. U. Tripp, Esq.	8·14	·91	8	15				
Patshull Gardens	Mr. T. W. Dell	8·88	·71	4	10	91·0	26	35·0	6
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	8·51	1·12	29	14	92·0	25	38·0	6
Wrottesley	E. Simpson, Esq.	8·71	·56	8	18	87·0	27	41·5	15
Tamworth	W. Arnold, Esq.	4·83	1·61	29	16				
Tean Vicarage, near Cheadle	Rev. G. T. Ryves	8·75	·75	12	14			36·0	6
The Heath House, Cheadle	J. G. Philips, Esq.	8·67	.77	12	16	82·0	26 & 27	41·0	6
Alstonfield Vicarage	Rev. W. H. Purchas	3·94	·76	5	10	88·1	27 & 28	34·0	6
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	8·69	·90	29	16	85·0	26	47·0	1
Coventry	J. Gulson, Esq.	2·86	·66	9	12	81·0	26 & 27		
Bickenhill Vicarage	W. R. Capel, Esq.	8·88	·49	11	17	81·0			
St. Mary's College, Oscott	Rev. S. J Whitty	2·85	·51	29	16	84·0	26	40·9	6
Henley-in-Arden	T. H. G. Newton, Esq	5·44	2·87	27	16	90·0	26	40·0	6
Rugby School	Rev. T. N. Hutchinson	8·15	·99	26	14	85·2	26	41·0	6
DERBYSHIRE.									
Buxton	E. J. Sykes, Esq.	4·15	1·15	4	16	80·4	26	36·0	2
Stoney Middleton	Rev. U. Smith	8·06	·75	4	11	88·0	27	30·0	5
Trent College	Rev. T. F. Fenn, M.A.	2·11	·50	8	9	89·0	25	39·0	1
Fernslope, Belper	J. G. Jackson, Esq.	2·81	·56	4	11	87·0	26 & 27	41·0	2
Matlock Bath	R. Chadwick, jun., Esq.	4·20	1·05	4	18	81·5	27	37·0	6
Linacre Reservoir, Ches'field	C. E. Jones, Esq.	8·08	·87	4	10				
Willesley Gardens, Cromford	J. Tissington, Esq.	4·10	·92	4	10				
Stuffynwood Hall	Mr. R. Rolfe	2·69	·81	4	12	88·0	26	39·0	1
Spondon	J. T. Barber, Esq	8·37	1·09	26	11	94·0	26		
YORKSHIRE.									
Tickhill, Rotherham	B. J. Whitaker, Esq.	2·28	·74	5	18	90·0	28	35·0	2
NOTTINGHAMSHIRE.									
Hodsock Priory, Worksop	H. Mellish, Esq.	2·14	·68	4	11	86·0	27	35·2	2
Grove House, Mansfield	W. Tyrer, Esq.	2·40	·58	4	15	88·6	27	38·2	2
Tuxford	J. N. Dufty, Esq.	2·18	1·05	4		91·0	26	41·0	15
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	1·80	·39	4	10	87·0	26	40·8	1
Ashby Magna	Rev. E. Willes	2·29	·65	9	11	87·0	26	42·0	6 & 15
Market Harborough	S. W. Cox, Esq.	2·25	·70	9	16	88·0	26 & 27	38·0	1
Kibworth	T Macauley, Esq.	1·82	·39	2	11	88·0	19		
Town Museum, Leicester	W. J. Harrison, Esq.	1·70	·44	9	15	85·0	26 & 27	41·5	6
Belmont Villas, Leicester	H. Billson, Esq.	1·78	·46	9	14	87·8	27	41·8	6
Syston	J. Hames, jun., Esq.	1·91	·44	9	14	93·0	27	40·0	2 & 6
Waltham-le-Wold	E. Ball, Esq.	2·03	·48	4	12	86·0	26	40·0	1
Little Dalby Hall	G. Jones, Esq.	1·55	·31	2	11	98·0	26	40·0	2 & 15
Coston Rectory, Melton	Rev. A. M. Rendell	2·50	·48	4	14	83·5	26	32·2	2
Belvoir Castle	W. Ingram, Esq.	2·63	·70	5	18	88·0	27	39·0	15
Foxton Locks	Union Canal Company	1·96	·45	26	8				
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	3·26	·69	2	15				
Castle Ashby	R. G. Scriven, Esq.	2·38	·50	8	18	86·0	26	41·0	14
Sedgebrooke	C. A. Markham, Esq.	3·31	1·23	26	14	95·0	27	32·0	15
Kettering	J. Wallis, Esq.	2·46	·58	29	13	84·0	27 & 28	43·0	2
Althorpe	W. F. Jakeman, Esq.	2·94	·61	17	13	85·0	26	38·0	1
Northampton	H. Terry, Esq.	3·84	1·40	26	15	87·0	26	38·0	16
RUTLAND.									
Burley-on-the-Hill	W. Temple, Esq.	1·82	·81	26	12	86·0	26	36·0	14
West Deyne, Uppingham	Rev. G. H. Mullins	2·86	·67	26	10	87·9	26	39·1	15
Northfields, Stamford	W. Hayes, Esq.	1·45	·32	9	7	85·0	26	40·0	1
Addington, Bucks	J. Mathison	2·19	·54	18	13	86·0	27	37·0	15
Radcliffe Observatory, Oxford	Mr. Lucas	1·92	·40	16	12	87·1	26	40·3	14
Spital Cemetery, Carlisle	T. Bell, Esq.	3·02	1·12	2	14	90·0	27	35·2	13
Ventnor Hospital	H. Sagar, Esq.	·76	·26	19	7	81·3	27	47·0	16
Altarnun Vicarage	Rev. G. Tripp	4·42	·89	11	15	88·0	27	38·0	1

Reviews.

Flowers: their Origin, Shapes, Perfumes, and Colours. By J. E. TAYLOR, Ph.D., F.L.S., F.G.S., &c., illustrated by thirty-two coloured figures, by Sowerby, and 161 woodcuts. London: Hardwicke and Bogue. Price 7s. 6d.

THE very interesting book, the title of which is given above, is written by the well-known Editor of "Hardwicke's Science Gossip." It is intended chiefly for such as have the desire but lack time and opportunity to make themselves acquainted with the varied and suggestive results of modern botanical investigation, otherwise than second hand. Dr. Taylor has summarised the more important of these results, and done so in a manner which will please most botanists and impart valuable and novel ideas to many whose knowledge of the recent labours of Dr. Charles Darwin and others is but limited. The first chapter is devoted to a consideration of what the author calls the old and new philosophy of flowers. The former had for one of the principal articles of its belief that flowers and plants in general were created solely for the delight or use of man. The teachings of the latter put this consideration in a subordinate place, and indicate that all the qualities possessed by plants of every description, flowering and flowerless, but especially the former, are just those which are of essential importance to the plants themselves. "Thus," to quote our author—

"Most flowers require crossing, and the floral machinery of even our common British wild flowers is of the most unlooked for and complex description, usually designed to *prevent* self-fertilisation and encourage or ensure *crossing*. Among some of the chief of these devices may be mentioned the following:—Absolute barrenness when the pistil is fertilised by the pollen of the adjacent stamens; pistils ripening before the stamens, or stamens before the pistil; *dimorphism* and *trimorphism*, or flowers possessing pistils and stamens of two and three lengths, all intended for the special purpose of crossing; the existence of *monœcious* and *diœcious* flowers, or those in which we have staminate and pistillate flowers on the same plant, but with the pistils and stamens separated from one another, and those in which one plant bears staminate flowers only and the other pistillate flowers. Most of these contrivances are not of a nature to invite attention; and some of them have escaped the notice of botanists for years, or had been remarked without being understood. We can, therefore, readily understand why they should be passed over by those who are totally ignorant of botanical structures. And yet it is these very organs and their arrangement on which the perpetuity of the species depends. . . . . The colours and perfumes, and in many instances even the *shapes* of flowers, have reference *only* to the visits of insects. And in proportion to the brilliancy or size of the corolla, or the sweetness of the perfume, is the necessity of the plants possessing them to be crossed. On the other hand, inconspicuous flowers are either self-fertilised or only occasionally require to be crossed; whilst the largest number of flowers, such as the grasses, sedges, rushes, &c., have no corolla at all, and do not require insect aid to carry the pollen from plant to plant, so as to beneficially cross them. Modern botanists find it comparatively easy to group all plants into two great divisions—those crossed or fertilised by insects and those by the wind. The terms *entomophilous* and *anemophilous* are applied respectively to these two classes. . . . . To such an extreme is the division between wind and insect-fertilised flowers carried out, that the microscopist can, without much difficulty, assign even pollen-grains to one or the other of these groups. Thus, the pollen usually produced by entomophilous plants have their surfaces roughened over with minute points or other means of readily attaching them to the hairy

bodies of insects. On the other hand, the pollen-grains of anemophilous plants are exceedingly light, usually round or lenticular, and expose as much surface as possible to the force of the wind which blows them about. . . . Darwin has shown that in some instances the relationship between certain insects and certain plants has been so narrowed that if the insects were absent from any locality the plants necessarily would be absent also. . . . Such a special connection between one group of the animal and one of the vegetable world we affirm need not interfere with man's enjoyment of the presence of either. It may operate as a check to his self-conceit to feel that flowers have not been primarily intended for himself; but, if his be a well-regulated mind, the marvellous inter-relationship between insects and flowers which science has thus brought to light will throw an additional halo of poetic interest over these unconscious agents, which, acting through blind instincts, have made the world more beautiful for those who can admire it." (Pp. 13-21.)

The chapters which follow relate to "The Geological Antiquity of Flowers and Insects," "The Geographical Distribution of Flowers," "The Structure of Flowering Plants," "Relations between Flowers and their Physical Surroundings," "Relations between Flowers and the Wind," "The Colours of Flowers," "The External Shapes of Flowers," "The Internal Shapes of Flowers," "The Perfumes of Flowers," "Social Flowers," "Birds and Flowers," and "The Natural Defences of Flowering Plants." Exception will, we think, be taken to some of Dr. Taylor's statements, and it would, perhaps, have been prudent had he been a little less positive in places. The tone of the book will make it acceptable to many who would probably be deterred from considering the subjects dealt with if presented as they undoubtedly would be by many modern botanists. The wide range over which Dr. Taylor travels will be gathered from the titles of the chapters quoted above. In each he has managed to compress much interesting, and, for those for whom the book is primarily intended, a good deal of novel information. As a popular and well formulated statement of the results won by the laborious researches of some of our foremost biologists, this volume has an undoubted value which ought to ensure for it a large circulation. There are many woodcuts and some coloured illustrations, not a few of which will be found most useful in elucidating the text.

Practical Taxidermy: A Manual of Instruction to the Amateur in Collecting, Preserving, and Setting-up Natural History Specimens of all kinds. By MONTAGU BROWNE. London: "Bazaar" Office, 32, Wellington Street, Strand. Price 3s. 6d.

IN this practical manual by Mr. Montagu Browne, Naturalist, Birmingham, the amateur taxidermist will find clear, concise, detailed instruction in "the art of preparing and preserving the skins of animals for cabinets, so as to represent their natural appearances."

The first chapter is of an exceedingly interesting character, giving in a complete form the history of the rise and progress of the "Skin Art," as Mr. Browne rather loosely translates it, and to correct which we have above given Dr. Ogilvie's definition of Taxidermy in full.

In the second chapter, which treats of trapping and decoying birds and animals, we should prefer that the author should substitute the word

"beasts" for "animals" in the title, as he is liable to be told that he is not a believer in the animalism of birds; also, it would be better to alter the title to "decoying and trapping," as it is essential that the animal should be enticed to the trap, or decoyed into it before it may be trapped. The opening observations in this chapter do, indeed, constitute a golden rule, and ought to be engraved on every rifle and fowling piece in use. Then, perhaps, the hideous scenes at Hurlingham, and other pigeon-murdering places, would cease, and sports having a healthier moral tone take their place. Mr. Browne has rendered good service in this chapter; it is a pleasure to read the details of making and setting each form of snare or trap, for the descriptions are lucid, easily grasped, and well illustrated, points which place this chapter above the average of such technical works; indeed, the value of such descriptions as those of traps, &c., and the methods employed in skinning and stuffing, are such as must be heartily appreciated by any industrious amateur or even professional taxidermist.

The question of the number of tools employed must rest, of course, with the amateur himself, and may depend upon the means at his command, but although so few are here recommended, the reader must remember that the educated fingers of an intelligent taxidermist, who knows well the habits and living appearances of the creatures he works upon when dead, supply the place of a boxful of bird-stuffing implements, however beautiful or costly.

The most important part of the book lies in the chapter on preservative media, which contains some very useful formulæ, comprising all the more important soaps, pastes, powders, solutions, and washes. Some of these are formulæ arranged and tested by the experience of the author, and which have enabled him to get up a large amount of first-class work, some of which those who saw the fine collection of preserved specimens at the recent Conversazione of the Midland Naturalists' Union in the Town Hall, Birmingham, will remember and appreciate. In this chapter, Mr. Browne starts an argument which he terms "Common Sense *versus* Arsenic," which, let us hope, will prove of real value to the members of his craft, by breaking down the old, foolish, and dangerous practice of using arsenic in any form. There cannot be a doubt in the mind of any experienced person that the destroyers of animal skins, more especially Tineæ, cannot face the powerful influence of light, and that a well-made cabinet, with plenty of light in its interior, will preserve properly cured and well-mounted specimens for a very long time, and this with or without arsenic. We call Mr. Browne's attention to the use of the word "meat" on page 57 and other parts of the book, and suggest that it is not so proper or useful as "flesh."

We quite concur in the idea that if a bird's head is to regain its proper appearances after being skinned so far as the eyes or root of the beak, the calvarium, or upper part of the skull, at least, should be retained undamaged. With regard to modelling the faces of animals, we should like to know whether the author has ever tried to fill up the hollows caused by the removal of the muscular and cellular tissues, with ordinary or even pipe clay, which is capable of such very nice finger and thumb manipulation after the skull has been replaced, as we find on

page 79 that he advocates the use of peat and plaster of Paris, which latter is sure to absorb whatever moisture may remain in the skull, skin, or case, and ultimately crumble to pieces, so spoiling the specimens in which it has been employed. A better method, where the skin is of a very greasy nature, as in dogs, &c., is to mix plaster of Paris with sufficient boiled linseed oil to form a thick putty, which resists all damp, is capable of much finger manipulation, and dries as hard as a stone, besides being non-poisonous and possessing the requisite lightness which, in the ordinary lead putty are still desiderata.

With regard to plaster casts of fruit, &c., (pages 107 and 108,) a much neater and readier method of making the mould is to mix a sufficient quantity of bees' wax with rozin in a pipkin over a slow fire. It must be used whilst just lukewarm, by either dipping the fruit, say an apple, until it is sufficiently coated, or by painting the surface of the apple until sufficient adheres to form a good, strong coating. When cold, (dipping in cold water will readily make it so,) the whole can be cut through with a sharp knife, the halves of the fruit come out easily, and a perfect mould in two halves is thus obtained. Fasten the halves of the mould together with string, and smear a little of the warm material over the joint to hold it together, and cast your model in the usual way with liquid plaster of Paris. When set, place in a little warm water, when the mould easily strips off, leaving a model of the most perfect kind, and at a small expense, for the mould can be melted up and used over and over again.

The remainder of the book contains many ingenious suggestions, which the practical taxidermist, as well as the enterprising amateur, would do well to carry out. Altogether, we must congratulate ourselves and Mr. Browne on the effect his book is likely to have upon taxidermy in general. The rubbish which for many years we have endured at the hands of self-styled taxidermists will, we hope, vanish before a more enlightened and careful manipulation of those beautiful creatures whose lives are so often sacrificed to the vanity of the collector, the sportsman's bag, and the follies of fashion. We sincerely hope that Mr. Browne's efforts to bring first-class specimens of his art into the houses of town dwellers will have a beneficial and humanising influence, and that his book, which in this particular branch of literature has no rival, will be well and widely read.—Wright Wilson, F.L.S., &c.

Report of the Rugby School Natural History Society for 1877. Rugby: W. Billington. 1878.

This is a really interesting, well-written, well-printed, and capitally illustrated volume. It is, we think, the twelfth report of the Society, (this should be stated on the cover,) and is not behind any of its predecessors in the additions which it makes to the Natural History of the neighbourhood of Rugby, or in the evidence which it affords of the thorough and interesting manner in which Natural Science is taught in the great School with which the Society is connected. Of fifteen papers read during the year, nine are by present members of the School.

Of these we note one on "Continuous Edges," by H. Weisse, which is highly ingenious and interesting. Others on "Snakes," by R. C. Cordiner; "Local Names," by H. F. Wilson; and "Autumn Moths," by J. Lea, show good powers of observation. The Rev. T. N. Hutchinson contributes an article on "Corroded Limestone in Yorkshire," illustrated by two beautiful plates drawn on stone by himself. The same contributor has also given a graphical representation of the Meteorology of the year as a frontispiece, but to this the lithographer has altogether failed to do justice. An interesting note on "Beavers in Bute" is illustrated by a humorous papyrograph drawing of "a beaver family engaged in the production of one of their well-known beaver hats," in which we recognise the skilful hand which enriched the 1875 report with some capital drawings of owls. The reports of the section include exhaustive lists of Rugby fossils, and of insects, birds, and new plants noted during the year. The report concludes with an account of the new Temple Observatory, where Messrs. J. M. Wilson and G. M. Seabroke, assisted by Mr. Percy Smith, will, we hope, long continue the excellent work which they did under the old and cramped conditions. The Observatory, as is well known, contains the Rev. Mr. Dawes' ("eagle-eyed Dawes") magnificent 8¼in. refractor, Alvan Clarke's masterpiece, which was purchased (a great bargain) by Mr. Wilson, for 400 guineas, and presented by him to the school. Altogether the report shows a most satisfactory state of things, and goes far to explain the numerous distinctions won at the Universities in Natural Science by Rugby boys of late years. If Martin (see "Tom Brown") ever revisits his old school, his delight and satisfaction must, we should fancy, be unbounded.—W. J. HARRISON.

The Birmingham Saturday Half Holiday Guide, with a Map. Third Edition for 1878. Birmingham: W. Walker. Price Sixpence.

WE wish there was as useful a guide book to the pleasant and interesting places within easy reach of every large town as the one named above is to the districts to which it relates. The plan of the book is admirable. From Birmingham, as a starting point, the places within easy walking distance surrounding the town are first disposed of; next, more distant places are described, most, however, being such as may be easily reached by a railway ride. Then follow a series of most excellent and suggestive papers on the Natural History of the locality, mainly contributed by members of the Birmingham Natural History and Microscopical Society. These articles relate to Botany, Conchology, Entomology, Geology, and Ornithology, while one, which is particularly good, points out the objects easily found which can only be examined by means of the microscope. Boating, Bathing, Bicycling, Cricket, and Fishing, as suitable sports for half holidays, are next dealt with, and complete one of the cheapest, most useful, handy, and interesting books ever written for the encouragement of healthy out-door occupations. The inception and completion of this volume are due to Mr. Joseph Sturge, who has spared no pains to make it a thoroughly trustworthy guide to the holiday seeker. There is a good map (reduced from the ordnance map) of the country for more than twenty-five miles around Birmingham.

Correspondence.

COMBINED WORK.—In reply to F. L. I hope to state, in our September number, my scheme for a combined examination of the Glacial Deposits of the Midland Counties, by the members of the Scientific Societies comprised in the Midland Union. In the meantime I shall be glad to receive suggestions from all who are interested in the subject.—W. J. HARRISON.

THE MAGNOPHONE, so called (page 187.)—It is to be hoped that this name will not be adopted, as it will add one more to the already sufficiently long list of incorrectly formed words. Magnophone is a hybrid, the first element being derived from the Latin, and the latter from the Greek language. If it is required to invent a word which shall mean "an instrument for increasing sound," it will be easy enough to do so. The word Megaphone has also been used; this is incorrect too; Megalophone is not liable to the same objection, and may be used if it can be accepted as expressing the required idea.—W. B. G.

SPURIOUS ANTIQUITIES.—We have just had forwarded for inspection and to report thereon a number of leaden figures, vases, &c., some of which bear the date 1001, and others 1010. They are evidently of the same description as those which were "sown" during the construction of the Thames Embankment, some ten or fifteen years ago. A medal of *Claudius Cæsar* cast in brass, which accompanies them, is of rather better execution, but still is plainly enough a *modern antique*.—LEICESTER.

PRE-GLACIAL MAN.—Walking through the Jermyn Street Geological Museum a few days ago I noted a remarkable addition to the case of stone implements. This is a palæolithic implement of yellowish flint, about three inches in length and of a type between ovate and pointed. It is still embedded in a reddish brick-earth. The accompanying label describes it as a "Palæolithic implement embedded in matrix of loam below the chalky boulder clay at Botany Bay Brickyard, Weeting, near Brandon." It was found by Mr. S. J. B. Skertchley, of the Geological Survey. As the chalky boulder clay of the eastern counties marks the height of the Glacial Period, it is evident that the finding of an implement undoubtedly wrought by human hands, *beneath* that boulder clay, is a satisfactory indication of the existence of man prior to or during the Glacial Period. We trust Mr. Skertchley will at no distant date make public the full details of his most interesting and important discovery.—W. J. H.

CUCKOO.—I do not know whether it has ever been noticed by your readers that the cuckoo is extremely active previous to rain. I have frequently noticed this during the spring, and could always reckon upon rain within two hours of his singing.—E. GRIFFITHS, Bishop's Castle.

CUCKOO.—In answer to your correspondent, N., I beg to say I have many times heard the cuckoo give the note mentioned, but have always concluded that it did so when alarmed. The first two notes are sounded somewhat slowly and the next four *very* much more quickly.—OBSERVER, Stroud.

CUCKOO.—The additional "Cucks" in the song of the cuckoo, mentioned by "N." in the last number of the "Midland Naturalist," are by no means uncommon, and may be heard most frequently when the bird is chasing another, or being itself chased; or sometimes—but more rarely—it appears to be uttered from very wantonness, a perfect volley of "Cuck-Cuck" being shouted out before the final "o-o."—MONTAGU BROWNE.

Cuckoo.—In answer to your correspondent "N.'s" enquiry, (p. 198,) I beg to say *it is quite common* for the cuckoo to repeat the first part of its note, or cry six or seven times in rapid succession just before its departure from our island; in fact, the cry "N." refers to is a sure indication of the bird being about to leave us. I cannot give a reason for it. It may, perhaps, be interesting to some to know that I have obtained a cuckoo's egg in the south of England as early as March 3rd, though the bird is seldom heard to utter "cuckoo" till about the 14th or 15th of April; and for some days after that the sound is exceedingly hoarse and indistinct.—J. R. Thompson, Tamworth.

Redpoll.—In answer to Mr. Rothera, although it must be conceded that properly speaking the lesser redpoll, common redpole, lesser redpole linnet, pea linnet, which are some of the common names for *Linaria rufescens*, (Viell.,) is the bird we intend when speaking of the "redpoll," yet arguing from analogous cases the Act would, I think, be found to embrace *all* birds coming under the general term "redpoll," *i.e.*, the "common," "gray" or "brown" linnet, *Linaria cannabina*, (L.,) which is really a "greater" redpoll, the *L. rufescens* instanced above, and also the mealy redpoll, *L. canescens*, (Gld.)—Montagu Browne.

Ornithological Notes.—The time is coming when the song of the birds mostly ceases. We have still, however, some of the best of them, the blackcap and garden warbler. The blackbirds and thrushes are only too numerous, and, as usual, claim a large share of the fruit, which must be placed on the other side of their account against the quantities of worms and snails of which their regular meals are made. I have noticed that the song of the thrush is in many cases quite different in the summer months from what it is in early spring. Some of the birds seem to amuse themselves with a repetition of the syllables "Weetah, Weetah," several times, followed by a somewhat monotonous chirrup, which is often repeated, and becomes rather tiresome to listen to. I suppose these must be the young birds of the present season, whose musical powers are not fully developed. Their song is much less agreeable than that of the older and more experienced performers. We have a good many of the gold-crested wrens about us this year. They are the smallest of all the British birds, and are very active and pretty. The nest is generally woven into the leaves at the extremity of a pine or cedar branch. We have also a great number of magpies all round us. They are great thieves, and their depredations amongst our little chickens and ducklings have made them very unpopular with us. I expect the comparatively innocent hawks and owls (which are much more easily shot) often get credit for the crimes which are really due to the magpie. When the young birds are fledged their appetite is ravenous, and the parents find the young ducklings hatched under a hen, and with no mother to guard them, an easy prey. They have carried off about half a dozen of these little ones, besides chickens. I do not object to their taking a fair share of the thrush's eggs, a delicacy they are fond of in early spring, and we can spare them some young blackbirds and thrushes, the remains of which bear frequent witness against them, but when they are seen to fly away with the little ducks there is a reasonable outcry against them.—John Gulson, Coventry. July 3rd.

Side-blown Eggs.—Will any of your correspondents describe the method of blowing eggs with one side-hole only?—E. A. Green, Normanton Rectory. [The following extract from "Practical Taxidermy," by Mr. Montagu Browne, Naturalist, Birmingham, published at the *Bazaar Office*, London, will give the information our correspondent requires:—"Eggs, when procured, must have their contents removed. To do this they

must first be drilled with little steel instruments called egg drills, which are made of various degrees of fineness, according to the size of the egg to be operated upon. Drills are to be procured from the various dealers, but can be made from steel wire softened in the fire and filed to a sharp three-cornered point—afterwards tempered to hardness—for the smaller eggs, or filed up for the larger eggs to the pattern of a 'counter-sink,' used for wood—indeed, the smallest-sized 'counter-sink' made, to be procured at any ironmonger's, will do very well for eggs the size of a hen's. To use these drills, rotate the point by 'twiddling' the drill between the finger and thumb, making only one hole, and that in the centre of the egg. When a nicely rounded hole is cut, the egg must be emptied by means of an 'egg-blower,' or blow-pipe; the point being introduced into the hole, the contents are blown out or sucked up into the bulb, which, when full, is emptied out at the other end. It sometimes happens that the egg is 'hard set.' The embryo must, in that case, be cut out with small curved scissors specially made. In all cases eggs should be thoroughly rinsed out with a solution of six grains of corrosive sublimate to an ounce of rectified spirits of wine. This may be sucked up into the bulb of the 'egg-blower,' and thence ejected into the egg, which is to be rotated, and what solution is left may then be sucked back and thrown away, or returned to the bottle. Great care must be taken, however, that the mixture does not pass the bulb and be drawn up into the mouth, as it is, of course, a deadly poison; the egg being placed (hole downwards) on blotting-paper, is to be left until dry."]

The Proposed Increase of the Subscription to the Midland Union of Natural History Societies.—I do not intend to discuss at present the question of this increase, but I desire to place on record an explanation personal to myself. As the Secretary of a Sub-committee appointed by the Birmingham Natural History Society, I conducted the negotiations which established the Union; and throughout these negotiations the principles laid down were those upon which the West Riding Union had been formed. The most important of these was one upon which I gave personal assurance to many of the Societies now in the Union that their pecuniary responsibility would be limited to one penny per member. Of the proposal made at the very first meeting of the Union to increase the levy to a shilling I knew nothing until, to my astonishment, it was made by the President of that Society on behalf of which I had acted. I therefore trust that any Societies of the Union who may see in this the appearance of a breach of faith on my part will understand that I am in no way responsible for it. I have expressed my sense of the false position in which I have been placed by resigning my seats on the Council of the Union, and on the Committee of the Birmingham Natural History Society.—Lawson Tait.

[The proposition to raise the subscription was fully discussed and adopted as a recommendation to the General Meeting at the Meeting of the Council which preceded the General Meeting, (as appears in the report,) as it had been found by the experience of the short time during which the Union had existed that the subscription fixed at the first meeting of the Council, on the assurance of Mr. Tait that it had been found to be sufficient by the West Riding Union, was utterly inadequate to carry on even the formal business of the Union, without taking into consideration the necessary expenses connected with the more important objects for which the Union was formed. Simultaneously with the above recommendation of the Council of the Midland Union, a circular was addressed by the West Riding Union to its members, (a copy of which was printed last month, at page 180,) stating it to be "perfectly obvious that the contributions paid by the affiliated Societies of one penny per member per annum are quite inadequate" for the objects of the Union. The proposal which Mr. Tait mentions was referred by the General Meeting to the different Societies to ascertain their opinions upon it, and surely the right of the Union to govern itself, and to make such alterations in its rules as may from time to time be found necessary, cannot be doubted. The subject is now under the consideration of the Societies, and will, as a matter of course, be decided according to the opinions of the majority.

Edward W. Badger, W. J. Harrison, Hon. Secs. to the Council.]

Gleanings.

DR. PRESCOTT JOULE has been granted a Civil List Pension of £200 per annum.

YORKSHIRE COLLEGE, LEEDS.—The late Mr. Henry Brown, J.P., formerly of Bradford, has bequeathed to the College £5,000, for founding and maintaining scholarships.

A NATURAL HISTORY MUSEUM is to be erected at Bolton. The foundation stone was laid early in July.

DIATOMACEOUS MATERIAL.—*Hardwicke's Science Gossip* announces that Mr. Clark, the Secretary of the San Francisco Microscopical Society, is now enabled, by the kindness of the State Geological Survey, to offer return exchanges of the Pacific Coast diatomaceous deposits on receipt of any valuable microscopical material.

SCIENCE AND ART DEPARTMENT.—Messrs. Chapman and Hall have just published for the Department, in one volume, a selection of the Free Evening Lectures, delivered in connection with the Scientific Apparatus Loan Collection, in 1876. Among these, as of local interest, we note Mr. Harrison's lecture "On the Study of Local Geology, with Illustrations from Leicestershire." There are also good papers by the Earl of Rosse, Professors Roscoe, Tyndall, Gladstone, Hull, Spottiswoode, &c.

DIPPING TUBE.—We desire to draw attention to a useful form of glass dipping tube, which can be obtained of Mr. Bolton, 17, Ann Street, Birmingham, for sixpence. It has a funnel top, on which some thin indiarubber is tied. There is a small hole in the side of the tube, which can be closed at will by one finger, when a slight touch of the stretched indiarubber cover of the funnel by another finger will, as may be desired, draw up or force out a column of water. The microscopist will find that under a dissecting microscope, with the help of this tube, he can readily pick out very minute and lively *Infusoria*, &c., for examination.

EXCURSION TO THE BAS BOULONNAIS.—The Geologists' Association has issued the programme of a week's visit (August 5—10) to the neighbourhood of Calais and Boulogne, there to inspect the eastern termination of our Wealden area, together with the Oolitic, Carboniferous, and Devonian rocks which crop out from beneath the former beds. The directors are M. E. Pellat, Dr. C. Barrois, and S. R. Pattison, Esq., and it needs little power of prevision to indicate a most pleasant and instructive week for those members who cross the Channel. England is evidently getting too small for our scientific societies!

A ROMAN VILLA has recently been found during some excavations at Abinger, Surrey, on the property of Mr. T. H. Farrer. The remains at present disclosed consist of a portion of the atrium, or reception hall, with a pavement of small red tesseræ, more or less worn in parts, and now well secured from the weather by a thick thatch of straw placed carefully over it; an apartment to the north-east of this, measuring 11ft. by 6ft., and divided from the adjoining ones by well-built walls of stone and brick, another room running eastward, of similar dimensions, and another below this, on the south side, of a square form measuring 11ft. 6in. by 11ft. Beyond, directly eastward, as well as southward, are indications of other chambers, but at present Mr. Farrer has not proceeded further in the excavations. Silver and bronze coins, red and white tesseræ, pottery, some pieces Samian, nails attached to portions of roof tiles, &c., have already been met with.

British Rainfall in 1877.—Mr. Symons' capital volume has been published since our last issue. It contains rainfall returns from about 2,000 stations in the British Islands, and is, as usual, an excellent example of the amazing perseverance and industry of the compiler. For the British Isles generally the year 1877 shows an excess of about twenty-seven per cent. *above* the average, the figures being as follows:—

	Depth in 1877.	Average.
England	46·22 in.	36·55 in.
Scotland	46·88 in.	37·32 in.
Ireland	43·14 in.	34·37 in.

The Collectanea Antiqua.—Mr. C. Roach Smith has just issued to his subscribers the first part of his seventh volume. It contains admirably illustrated papers on Roman Potters' Kilns discovered near Colchester; Notes on some of the Antiquities of France; Roman Leaden Seals, and British Oppida and Roman Castra. In the last-named paper the author points out how commonly the British or Celtic earthworks are confounded with Roman camps, and illustrates this by reference to the fortification at Lingfield Mark, in Surrey. The fine earthwork on Borough Hill, in Leicestershire, we consider to be certainly of British construction, and we trust to describe it, with some others in the same county, in a future number of the "Midland Naturalist."

Rhætic Fossils.—The beautiful star-fish, *Ophiolepis Damesii*, (Wright,) first found in England by Mr. Harrison, near Leicester, turned up some time afterwards at Garden Cliff, on the Severn. We now hear that the same radiate has been found by the Rev. P. B. Brodie, near Stratford-on-Avon, and by Mr. H. J. Elsee, near Rugby. Evidently it only wanted looking for.

South African Fossils.—To lovers of science it may not be uninteresting to know that a collection of fossil Saurians has just been shipped for England by Mr. Thomas Bain, who, at the request of Professor Owen, was allowed by the Government to undertake the work of collecting. It consists of 308 crania of the Dicynodon, Oudenodon, Lycosaurus, Galesaurus, and the Cynodracon, and some skulls apparently quite new to science, fossil wood, vegetable impressions, and a sample of Beaufort coal. Mr. Bain found the head of a Saurian in the matrix of the coal, within two feet of the seam, a fact, he considers, worthy of record, as it may give some clue to determine the age of our Cape coal period, about which there is much diversity of opinion at present.—*The Cape Argus.*

Roman Inscriptions.—In the Leicester Town Museum there is an interesting fragment of the beautiful red polished ware known as Samian, which the Romano-British settlers imported from Gaul, and which they prized so highly. It is a slightly curved piece, perhaps originally part of the rim of a bowl, and is about 3½in. long by 1½in. broad. It is pierced for suspension round the neck, and on it is incised, in a bold, clear letter, VERECVNDA LYDIA, LVCIVS GLADIATOR. Evidently it was a present, a keepsake, from one Lucius, a gladiator, to Verecunda Lydia, his sweetheart. It was found in Bath Lane, Leicester, during the progress of the sewerage works in 1854, and is believed to be the only inscription extant from the hand of one whose stated occupation it was to brave the perils of the public arena.

Reports of Societies.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY.—June 10th. The members made an excursion to the Vale of Llangollen. Among the places visited were Crow Castle, Valle Crucis Abbey, Llantisilio, and the Berwyn Hills, from which they obtained a very fine view.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—General Meeting, July 2nd.—The following exhibits were made by Mr. Hughes, on behalf of Mrs. Randall:—*Echinocyamus pusillus*, the Green Pea Urchin, from Falmouth, and mounted specimens of *Spatangus purpureus*, showing the spines peculiar to that species; by Mr. J. Bagnall, a Stag Beetle, (*Lucanus cervus*;) by Mr. H. E. Forrest, a fine living specimen of *Spongilla fluviatilis*, from Sutton; *Argulus foliaceus*, the fish flea, taken from the dead body of a roach, at Windley Pool, Sutton; and a fine specimen of *Carchesium*, found in an aquarium; by Mr. Bolton, a young Newt, *Triton punctatus*, showing the circulation in the gills and pulsations of the heart; by Messrs. Caldwell and Butterfield, a large number of plants; by Mr. T. J. Slatter, a well-preserved specimen of a species of fern, from a band of marly clay, in the Waterstones and Lower Keuper Sandstones, near Redditch. The remaining meetings during the month were devoted to the exhibition of specimens contributed by various members. July 19th.—At 10 30 P.M. a party of twenty-eight of the members left Birmingham, *via* Midland Railway, for Arran, which they reached before noon the following day, where they remained till Saturday, July 27th. A steam yacht having been secured for the week, much active work in dredging was done, with what result will be reported in a future number.

BURTON-ON-TRENT NATURAL HISTORY AND ARCHÆOLOGICAL SOCIETY.—On July 10th, under the leadership of Dr. Perks, the members made an excursion to Wall (the Roman Etocetum) and neighbourhood. Reaching Walsall by rail they proceeded next in carriages to Barr Beacon, an isolated eminence, from which on a clear day a vast tract of country is visible. Sutton Park and the neighbouring town of Sutton Coldfield were afterwards visited. In the churchyard of the latter is the grave of Mary Ashford, who was supposed to have been murdered by Absalom Thornton in 1817. The accused on arraignment pleaded not guilty and offered the "Wager of Battle." There being no one to accept the challenge on behalf of the murdered girl, Thornton escaped. He emigrated to America, where he died in 1870. It was this case that brought about the repeal of the statute under which Thornton availed himself of the "Wager of Battle." Shenstone was next visited, where the party were met by Col. Bagnall. In the churchyard is an ancient dial shaft, now surmounted by a cross, on which the Rev. R. W. Essington, the present vicar, has caused the following inscription to be placed:—

If o'er the dial glides a shade, redeem
The time, for lo, it passes like a dream;
But if 'tis all a blank, then mark the loss
Of hours unblest by shadows from the Cross.

From Shenstone the party proceeded to Wall, which is believed to be the site of the Etocetum of the Romans. Col. Bagnall stated that some years since he made a series of excavations in the neighbourhood, and found a great quantity of bones of horses, swine, deer, and other animals, a large quantity of bronze, &c. Copper coins and fragments of glass had also been dug up, as well as large quantities of charcoal and Samian ware. It is said that where Wall Church now stands was originally the site of a temple of Minerva. Dr. Perks commented upon the fortifications of Wall, and, in referring to the Roman Vallum discovered and described by the Rev. S. Shaw, contended that it was highly probable that another Vallum had run in a south-easterly direction to the hill on which Shenstone Church now stands, and that the two would afford an imposing and extended barrier to any attack from the north-east. The excursionists proceeded to Lichfield, from whence they took train to Burton.—On July 20th the members, under the guidance of Mr. Thos. C. Martin, (hon. sec.,) went to Alrewas and Wichnor, where they were joined by members of the North Staffordshire Field Club.

EVESHAM FIELD NATURALISTS' CLUB.—The second excursion of the club took place on Saturday, June 29th, to Dovedale, near Blockley. There was a small attendance, and only botanical specimens were taken. They included the following:—*Listera nidus-avis*, *Paris quadrifolia*, *Spiræa filipendula*, *Vicia sylvatica*, *Campanula glomerata*, *Digitalis purpurea*, and *Aquilegia vulgaris*. A meeting of the club was held on Tuesday, July 2nd. The Chairman (Mr. A. H. Martin) exhibited eggs of the red-legged partridge found at North Littleton.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY. —Natural Science Section.—June 29th. An excursion was made to Stanton-by-Dale and West Hallam. The party visited an interesting cliff of calcareous Bunter conglomerate near the Stanton Gate Station, and the Millstone Grit and Bunter quarries were also seen. Near Dale the Kilburn coal seam is worked from the outcrop. This seam is 4ft. in thickness, and is the lowest seam worked in the Midland Coal-field. At Dale the ruins of the abbey and the picturesque little church were seen, and near Stanley a quarry in the Coal Measures sandstone. The Botanists of the party obtained a large number of interesting plants. A field near Stanton Gate is remarkable for the number of species it contains, *e.g.*, as many as five of the Vetches, including *tetrasperma*, being found within a very short distance. *Jasione* and *Genista tinctoria* are also very abundant. The *Orobanche*, which is said to grow near Dale, was not found.

OSWESTRY AND WELSHPOOL NATURALISTS' FIELD CLUB AND ARCHÆOLOGICAL SOCIETY.—Third Excursion. July 17.—The meeting-place was Wrexham. After a visit to the fine old church, the party took train to Cefn-y-bedd, whence their route lay up the beautiful Nantyfridd Valley, a narrow wooded dell, along which runs the line of the Great Cambrian Fault. Rocks of mountain limestone and millstone grit protrude here and there. At the upper end of the valley is a very pretty waterfall. Here the party left the valley, and proceeded over the hill to Minera, celebrated for its lead mines and lime works. Here a break met them, in which, after seeing the church, they returned to Wrexham. The day was lovely, though very hot. Among the plants found, we may mention *Corydalis claviculata*, *Hypericum Androsæmum* and *montanum*, *Geranium pratense* and *lucidum*, and a beautiful white variety of *G. Robertianum*, *Campanula latifolia*, *Cystopteris fragilis*, and *Polystichum angulare*.

PETERBOROUGH NATURAL HISTORY AND SCIENTIFIC SOCIETY. —On June 22nd, July 6th, and 20th, afternoon excursions were made in the neighbourhood of Peterborough; also evening excursions on June 25th and July 3rd. On the 8th, 17th, 24th, and 29th inst. evening botanical excursions took place, and were highly satisfactory.

WOOLHOPE NATURALISTS' FIELD CLUB.—On June 20th there was a large gathering of members at Ross for Symond's Yat and the Doward. After visiting the recently-erected church at Ross, the party proceeded to Symond's Yat, on the top of which the formal business of the Club was transacted. Mr. H. Southall pointed out and named the surrounding hills, &c. The members then took boat about a mile down the Wye to the Dripping Well, which was examined. Proceeding further down the river to the Old Fish House, they landed and visited King Arthur's and the other Caves. Little Doward Hill was then ascended, through the woods, to the Iron Tower. After passing through the Leys Park, the party proceeded in carriages from Crockford's Ash to Ross. After dinner, Mr. Southall read a most interesting paper on the Doward Caves, the botany of the district, &c., &c.

Notices to Correspondents.

We shall be glad to receive communications from the Members of Natural History Societies in any part of the kingdom.

All communications should reach us not later than the 18th of the current month, if desired for insertion in the next issue. We shall always be willing to insert communications relating to Exchange of Specimens.

For prices of advertisements address, the Midland Counties Herald Office, Birmingham.

All communications to be addressed, The Editors of the Midland Naturalist, Midland Counties Herald Office, Birmingham.

ECONOMIC MYCOLOGY.*

BY J. GRIFFITH MORRIS, ESQ.,
PRESIDENT OF THE WOOLHOPE NATURALISTS' FIELD CLUB.

In the work of education during early life little is done to draw out and develop two of the principal faculties with which man is endowed—observation and manipulation. Habits of seeing quickly, observing accurately, and discriminating minutely are not acquired without learning to use the eyes. Nor are delicacy of touch with lightness, accuracy, and steadiness of manipulation without a similar education of the hands. Readiness and accuracy of investigation and observation are likely to be of more service to most men in everyday life than any amount of scholarship, whether classical or mathematical. Examining Boards are now doing much to enforce the study of science at schools, and the coming generation, not content with exclusively classical teaching, will go forth into the world better prepared to advance the material interests of mankind.

This earth is beautiful indeed,
And in itself appeals
To eyes that have been taught to see
The beauties it reveals.—*Montgomery*.

From the study of any branch of Natural History two sources of advantage are to be expected—a beneficial result on the mental and physical powers of the individual, and the practical utility of the knowledge gained. The student becomes a wiser and better man; he becomes elevated and refined, a love for the true and beautiful is created within him, and his enjoyments are increased in proportion.

Mycology is a subject with which the name of the Woolhope Club is especially connected; it well illustrates the truth of these remarks, and inasmuch as little progress can be made in its study without the aid of the microscope, additional educational advantages arise, for that instrument in itself demands the practice of patience, order, and observation, and developes the senses of sight and touch.

Mycology presents a wide and fertile field of research. The progress of recent science demonstrates more and more that the growth, reproduction, and life-history of minute funguses is of vast importance in the economy of nature. To their unseen causation are due most of those changes which affect organic life. Under their influence organic tissues alter their form of vitality.

What is called decay is in truth only a process to other forms of life, sometimes beneficial to man in the production of wholesome food, but more often injurious by causing disease and pestilence.

It is ten years since the Club commenced the study of Agarics, and that series of discussions and papers began which have since given so much renown to it. The subject was scarcely introduced when in the following year prizes for collections of funguses were for the first time given at South Kensington, and Dr. Bull took the chief prize for Herefordshire.

* Part of an Address read before the Woolhope Naturalists' Field Club, at the Annual Meeting, held at Hereford, on April 23rd, 1878.

In the autumn of 1868 the first Fungus Foray was made to Holme Lacey, under the superintendence of our staunch friends, Messrs. Lees and Worthington Smith. These forays have gradually grown in interest, increasing numbers join them, and an abundant supply of papers notifying new facts and discoveries is annually read.

Many of the most distinguished mycologists have done us the honour of attending them. The Club will be proud to mention the names of Berkeley, Broome, Cooke, Currey, Plowright, Phillips, Renny, Vize, Houghton, Percival, Cornu, De-Seynes, and several others who have again and again been present at our forays.

The active interest of our members in the study of funguses was at once excited by calling attention to the edible kinds. It was shown that a large amount of vegetable matter containing nitrogen, hitherto allowed to waste year after year, might be utilised as food. Experience has shown, however, that an idea so philanthropic is not in England practically feasible. Few species of Agaric are edible, more are tasteless or disagreeable, and some that are poisonous are unfortunately too common.

The comparative scarcity of uncultivated land in this country, and the uncertain and, as it were, capricious growth of Agarics, put quite out of the question any reliance on them as a source of food for the people, the more especially as other food is happily so abundant. It still remains, however, for the scientific epicure to distinguish and profit by them, as he assuredly may do, and gather from them a varied and delicious relish.

The study of Mycology deserves all the ardour with which it has been recently followed; to it we owe the knowledge of those destructive agents, the various kinds of moulds, smuts, rusts, &c., that are called blight. The term blight is too indefinite. It is indiscriminately applied to funguses, to insects, and to diseases caused in the young and tender parts of plants by sudden alterations in the temperature or the amount of moisture in the atmosphere. Most living plants and animals are at times more or less infested with funguses, which are nourished at their expense, very often to the eventual destruction of both. Some of these parasites attack man himself, as shown by the production of various kinds of ringworm and thrush. The belief is growing that diphtheria, cholera, low fevers, and other such complaints, may be caused by microscopic funguses. It is an unhappy fact that these parasitical pests take up a residence on those vegetables that are the most useful to man, viz., those which produce starch. Of these the cereals are the most important. Rust and mildew attack the leaves, stem, and bracts, while ergot, smut, and bunt attack the organs of fructification of barley, wheat, rye, oats, maize, rice, and other cereals.

The corn rust and mildew are the same species of *Puccinia* in different stages of growth. It may be found on almost every grass in every part of the world; but it seems to have a preference for wheat. General attention appears to have been directed to it for the first time in 1804, when Bauer made drawings for George III. The wheat of that

year contained only 604 parts of starch and gluten in 1,000 parts, instead of the 995 parts of the nutritious matter which it ought to have contained. In 1806 the quantity was absolutely reduced to 203 parts. In 1810-11-12, when wheat was at its highest price during the war, corn rust was so prevalent and severe, the foliage of the plants so eaten up with it, and in consequence the grain so small and shrivelled, that, much as it was wanted, it was not considered worth while to thrash it out. It has been noticed that severe attacks of corn rust have more than once been coincident with the appearance of cattle plague. The last time that the cattle plague was prevalent in this country the clothes of people walking through corn fields became orange coloured from the dusty spores falling on them.

Smut is individually a very minute fungus, and yet of all the corn parasites it most readily attracts attention. It is a species of *Ustilago* that attacks the anthers and ovaries of wheat, barley, oats, maize, and rice, plants whose fertility and well-doing are of the utmost importance. It appears as a white viscid fluid, which dries up into a sooty, pulverulent mass. A German some years since attempted to prove that this powder was simply a collection of diseased cells, and therefore not a fungus, but he was easily refuted, for he was shown in the microscope the germinating spores.

Bunt *(Tilletia caries)* is a concealed foe, its residence is in the growing seed, and it is not till the farmer takes his sample after thrashing that he detects the presence of this pest (the little bunch of pappus at the upper end of the seed is not white, as it ought to be, but dark and dusty.) On careful search he then finds some distorted grains containing a fœtid powder, which under a microscope is seen to consist of brown reticulate spores. Of course the presence of much of this fungus would be detected in the flour by its colour and smell, but the millers get rid of the affected grains by rolling and blowing. This fungus has not been destructive for some years.

In northern and cold countries where the soil is poor, rye is almost the only cereal grown. This grain is peculiarly liable to the attack of a fungus called Ergot. It is often present in such large quantity that when ground up and eaten a train of peculiar symptoms is produced, called ergotism, and instances are mentioned in which the continued use of the diseased grain has caused death. The same fungus grows on some of our pasture grasses, and often occasions great mischief to cattle.

In some parts of France the peasantry do not object to eat mouldy bread, and in most instances with impunity; but the species of mould varies, and alarming effects have sometimes followed. These, together with experiments performed on animals, prove that bread in a state of mouldiness will cause death. M. Barrul, the French analyst, who reported to his Government on these cases, advises "that as most people are unable to distinguish the species of mould, the use of all bread in such a condition should be avoided."

Next in importance to corn as a starch producing vegetable is the potato. Many funguses attack it. The *Peronospora infestans*, that is so

very destructive, is one of the white moulds. The mycelium of this fungus is able to penetrate every part of the plant, discolouring and corroding the green parts, and causing loss of vitality and decay in the tuber. Partial observations of several mycologists had revealed much of its life history and mode of growth during the summer, but it was left for an honorary member of the Woolhope Club to discover how it survived the winter. It has long been known that some funguses, like insects, go through several stages or metamorphoses. The final and perfect stage is easily recognised in most insects, because that is the only one that has the power of reproduction; but among funguses every stage is able to propagate itself in some way; thus in summer the potato blight throws off from the free ends of its mycelial threads two kinds of short-lived spores, which, if they fall on the leaf of a potato, germinate and quickly reproduce themselves, killing their victim and perishing with it.

Our friend Mr. Worthington Smith had the good fortune, while investigating the natural history of this fungus, to discover another kind of spore, called a resting spore, because it hybernates in or on the ground. He watched its mode of formation in the autumn and its growth the following spring, and thus was enabled to prove that this spore was the long sought for means by which *Peronospora infestans* continues its existence from year to year.

This spore is to be found in the tissues of the decaying plant. It is formed by a process of conjugation not uncommon among funguses. By degrees it acquires a hard protecting coat, and, with the dying plant, falls to the ground, where it remains to take its chance during the winter. On the return of warmth, the hard coat bursts, mycelial threads exude, and extend in search of a foster mother. If they do not meet with a potato plant in growth, they speedily exhaust themselves, and die; but if unfortunately successful, they pierce the cuticle, and the work of destruction commences.

Through want of thought and custom, much is done that favours the existence and propagation of this pest—diseased haulm and tubers are left on the surface of the ground when the crop is taken up, and are afterwards dug in to serve as manure. If this happens in a garden or rented potato ground, and the same crop is put in a second year, a vigorous crop of *Peronospora* is the result, and the cottager scarcely gets his seed back. The potato blight is also extensively propagated in another way. It most houses it is usual to throw away diseased tubers along with parings and other rubbish into dust heaps, which are in due course carted away and used as manure. It is probable that storing potatos in the same buildings or floor year after year, favours the spread of the disease.

Mr. Worthington Smith's discovery teaches that every part of an infected plant should be burnt; it is the simplest way of effectually destroying the fungus; and also, that under no circumstances should potatos be planted for two consecutive years in the same ground.

Parasitical fungi, not content with damaging corn and potatos, are also very injurious to garden produce; cabbages, beans, peas, celery, and onions, each of them cherish and foster some unbidden visitor; fruit trees, as pears, plums, peaches, filberts, and walnuts furnish a residence for some unwelcome intruder.

Flowering plants, grown for their beauty, are much injured, and sometimes killed, by parasitical funguses; witness the rose trees and hollyhocks. Two years out of three hopyards are rendered unproductive by attacks of an *Erysiphe*.

Timber trees do not suffer much while in growth, yet it is curious to number the varieties of fungus found on them. M. Wessendorf says that "seventy-four attack the lime, of which eleven reside on the leaf; 114 the spruce fir, and no less than 200 the oak;" among the latter are reckoned those funguses whose ravages in timber-built ships have occasioned a loss in fourteen years estimated at twenty millions, and which in church and domestic architecture produce great annoyance and expense by causing dry rot. *Merulius lacrymans*, *Polyporus hybridus*, and a *Thelephora* are the funguses which prey on sound timber; their mycelium creeps between the cells, and decomposes the lignin and cellulose; the *Merulius* has a rusty-coloured irregular stemless pileus, from whose gills a liquid constantly exudes.

If the useful plants of other countries are examined, we find in the south of Europe olives, oranges, and onions damaged by a fungus that envelopes their leaves in a covering of soot; in the Atlantic isles and France the *Oidium Tuckeri* destroys the grape vine. This fungus first appeared in an English hothouse, and thence has spread in all directions. Our friend, M. Cornu, told us last October that another fungus had lately appeared on the vine at Narbonne, causing a disease called Anthracnose. In some parts of Italy the cultivation of the silkworm has been suspended because it is attacked and destroyed wholesale by a species of mould somewhat resembling that which kills flies in the autumn, and leaves them adhering to the glass in our windows, surrounded by a cloud of white spores. In America the maize is often much injured by a smut that causes large and curious distortions of the grain and cobs. The plant which of all others is the most important for clothing purposes—the cotton plant—has two formidable enemies. One attacks the leaves, the other the pods.

Some manufactures are much impeded by the growth of moulds. Bleaching cannot be carried on in the fields on account of moulds growing and causing unsightly and irremovable blotches on the fabric. The preparation of gelatine, maccaroni, lime juice, and wines requires precautions to be taken to prevent access of air containing spores of funguses. It would not be difficult to extend the list of noxious funguses, but enough has been said to show that man's person, food, clothing, building materials, and occupations are all injured by divers species of fungus. In proportion to the amount of injury they cause, they become important. It must be desirable, therefore, that their structure, habits, and life-history should be carefully studied, so that advantage may be taken of every opportunity of lessening or preventing their injurious effects.

The chemical process of nutrition in funguses is not the same as in other vegetables. Funguses do not convert inorganic matter into organic compounds. They possess a vital force capable of overcoming the natural play of chemical affinities, and they live by appropriating the constituents of the compounds they are thus enabled to decompose. Fermentation is nothing more than the manifestation of this process of decomposition. Such fermentations as are not produced by the immediate action of living cells are called indirect. They are caused by the intervention of nitrogenous soluble matters elaborated by living cells. These soluble ferments are often stored up till circumstances require their alterative action. It would seem that most organic substances are subject to fermentative changes, often occasioned by a special ferment plant. There are other ferment plants besides those that are recognised as funguses. Sugar undergoes several direct fermentations—the alcoholic, lactic, vinous, and butyric. Alcohol by fermentation becomes acetic acid; albuminous matters and urea are transformed into ammonia by processes of fermentation.

It will be interesting to sanitarians to know that there is reason for believing that the conversion of ammonia into nitric acid is caused by the presence of a fungus; this process has been called nitrification. It goes on constantly in soil that is saturated with decomposing animal matter. The saltpetre of commerce is for the most part imported from India, and is obtained by washing it out of the soil. Nitrification has long been known and carried on artificially. Pasteur suggested that it might be a fermentative change, and some recent experiments show that he was probably correct. MM. Muntz and Schliessing passed sewage water through a porous medium; for eight days there was no change in the amount of ammonia, but after that time ammonia disappeared and nitric acid took its place. This experiment is only explicable by supposing that germs of a ferment plant were present and took time to mature. This notion was confirmed by another experiment, which proved that the presence of antiseptic vapours suspended the action.

Among fermentations the alcoholic takes the first rank; it is the most familiar and the most easily studied. There has been considerable difference of opinion as to the nature of the plant which causes this fermentation. Most English authorities have considered till lately that it was a modified growth of a common mould called *Penicillium*. German mycologists make it into a genus belonging to the class *Torulæ* among funguses. They call the genus *Saccharomyces*, and include within it several species.

Common yeast is *Saccharomyces cerevisiæ;* the composition bakers use has very small cells and is called *S. minor*. The yeast that grows on malt liquor when left to spontaneous fermentation, as is the practice in Belgium, is *S. apiculatus*. Other species appear on musts of wines, and juices of stone fruit. The species that is so important in this district, because it effects the transformation of apple juice into cider, appears under the microscope to be identical with that which is found on malt liquor, viz., *S. apiculatus*. Pasteur has proved by a simple experiment that germs or spores of *Saccharomyces* exist on the surface of grapes. He

introduced boiled grape juice into a series of thirty flasks; of these ten were immediately sealed up; into a second ten he dropped a minute quantity of liquid prepared by washing the surface of some ripe untouched grapes; into the third ten he passed some of the same liquid boiled. In forty-eight hours the first ten were unaltered, the second ten were in full fermentation and filled with flakes of mycelium, the third ten were unaffected. There is reason for believing that all saccharine fruits have on their surface spores which remain quiescent till a concurrence of circumstances brings them into contact with the enclosed juices, then subaqueous growth commences accompanied by the decomposition of the sugar. So long as the subaqueous growth continues propagation of the fungus takes place by budding, but as soon as the sugar is exhausted the fungus comes to the surface and forms spores. *Saccharomyces cerevisiæ*, or common yeast, is seen under the microscope to consist of a multitude of granular cells, diffused through a turbid liquid called yeast water. The cells are about 1-3,000 of an inch in diameter, and, like all other vegetable cells in their simplest stage, consist of a speck of jelly called protoplasm, enclosed in a non-nitrogenous envelope. Yeast is composed principally of albuminous and amylaceous matter, but it contains a large proportion of phosphates of potash and magnesia. The remarkable feature in its composition is its richness in nitrogen. Funguses contain more nitrogen than any other class of plants. The *Chantarelle* contains 3·62 per cent., *Boletus edulis* 4·25, *Lactarius deliciosus* 4·60, mushroom, 7·26, and yeast 10, so that it closely approaches animal matter. These Agarics have been selected for comparison because they have been often set before us at our Fungus Foray dinners. Knowing the chemical composition of yeast, we should expect the medium in which it flourishes to contain the nitrogenous and mineral matters which it requires. It has been proved by experiment that yeast will not exert its peculiar action on sugar unless these matters are present in solution.

We all know that if yeast be added to a liquor at a suitable temperature in which malt or some saccharine fruit has been digested, certain occurrences will ensue. The liquor will shortly become turbid, effervescence will take place from the escape of free carbonic acid, the sweetness will disappear, alcohol will become evident to the taste and smell, and a large increase will take place in the bulk of the fungus.

There are several varieties of sugar much alike in their chemical composition and properties. The two principal are saccharose and glucose. Yeast acts differently on each, so that it will be well to trace back their relation to, and formation from, starch. Starch, chemically, is nothing more than carbon, combined with the elements that compose water in the proportion of six to five. It appears to be the first product of that decomposition of carbonic acid and assimilation of the carbon, which, under the influence of the sun's rays, is continually going on in growing plants. Starch is the basis from which most other vegetable secretions are formed. It is either used up at once by the plant that secretes it, or it may be laid by for future use; sometimes in the tuber as in the potato, in the seed as in corn, or in pith as sago. Saccharose,

the sugar of commerce, or cane sugar, is made up, like starch, of carbon and water; but the proportions differ. Instead of six to five, in saccharose it is twelve to eleven. This sugar is found in the maple and beet; whenever found it is intended as a store for the future use of the plant at the time when a great and sudden demand is made for the purposes of reproduction. Glucose is the sugar met with in the grape and other fruits; it contains a little more water than saccharose and is more soluble. It is necessary that stored-up starch and saccharose should be altered into glucose before they are used by the plant. This alteration is always prepared for by the laying up of nitrogenous matter in close approximation with the stored material. When the food is wanted, the nitrogenous matter acts as indirect ferment, and causes the starch or saccharose, whichever it may be, to take up an additional quantity of water and become glucose. Thus the starch stored up in the barleycorn is altered into glucose when heat and moisture bring the nitrogenous matter called diastase (which has been laid up under the cuticle) in contact with it. This process takes place in seeds when they germinate, and is taken advantage of by the maltster. For the same reason the tuber of the potato becomes sweet and transparent from the alteration of its sugar into glucose when growth begins. Again, when sugar cane and beet blossom a large supply of nutriment is suddenly wanted; the stored-up saccharose is then digested; that is, altered into glucose, and is carried away in the sap to the reproductive organs, to be there reconverted into starch, and stored up again in the seed. Parsnips and some other sweet roots that do not blossom the first year, lay up glucose itself, which is held in reserve till the next summer, then seed is formed and the root loses its sweetness and collapses.

If yeast be placed in water containing air or oxygen, the oxygen gradually disappears and is replaced by carbonic acid; a process exactly similar to the respiration of fishes, continuing day and night, but proportionately more active. The yeast would die when the oxygen was absorbed, but if glucose be then added, the fungus will abstract from it the oxygen required, and set free carbonic acid and alcohol. Pasteur, who has given great attention to the life-history of ferments, has concluded, after many experiments, that a continued supply of oxygen and the combustion it causes are necessary sources of energy for the development of vitality in ferment plants. As soon as the cells of yeast have exhausted the glucose in contact with them they have a tendency to come to the surface and take on their aerial growth, which is simply the formation of spores. Under favourable circumstances some of the cells at the surface may be observed under the microscope to form an additional internal membrane, which, becoming septose, divides the protoplasm into three or four parts; each of these parts becomes spherical, opaque, and is ultimately detached as a spore. The nutrition of yeast in one particular resembles that of the higher orders of plants, for it is supplied with a soluble nitrogenous ferment which enables it to alter saccharose. This nitrogenous matter may be separated by washing the cells in water, every time they are washed some of it is dissolved out, it is always acid, and if neutralised becomes again acid, directly that it

comes in contact with saccharose the latter is forced to take up an additional atom of water and thus become glucose. The multiplication of the cells of yeast by budding is a process that may be easily watched under the microscope. If the temperature is kept between 75 and 90 degrees, one or more cells may be seen to arise in succession, or even at the same time, from a parent cell, and form themselves into short irregular chains. The vitality of yeast is dormant below 50, and is destroyed, as we should expect, at 140 degrees, for at that temperature nitrogenous matter begins to coagulate. The growth of yeast is checked if the solution of sugar is too dense, or if the quantity of alcohol is too large. Attempts have frequently been made by physiologists to account for these phenomena, but how and why carbonic acid and alcohol are substituted for sugar is still a mystery, and, like other mysteries connected with vitality, is likely so to remain. It has been ascertained that the weight of the alcohol and carbonic acid is nearly equal to the weight of the sugar which has disappeared. The slight difference is caused by the formation of other compounds that only appear in minute quantities. Some think that the glucose and other materials that form the food of the yeast plant penetrate the cell by osmose, and there, after undergoing transformation, are assimilated and converted into growing cells and tissues, while at the same time disassimilation is proceeding, the worn-out tissues are changed into alcohol and carbonic acid, and are eliminated as excrementitious matter. This may be called the intra-cellular theory. Pasteur is of opinion that the vital action of the cell causes decomposition of the glucose, and that a portion of its oxygen penetrates the cell membrane and takes part in the process of assimilation, while the other constituents of the glucose are left outside free to arrange themselves into carbonic acid and alcohol. This is the extra-cellular theory. Which is correct? It remains for some one, perhaps a Woolhopian, to determine.

In this agricultural and woodland county there is abundant opportunity for the study, not only of the parasitic funguses, but of most others, and as our Field Club was constituted for the purpose of observing and recording all facts connected with the Natural History of the district, it is to be hoped that some of our members will forthwith set up their microscopes and become students themselves. The facts observed at the time may often appear isolated and of little consequence, but subsequently by combination and further discovery they may become of the greatest value. Minute scientific research always precedes the application of science to industry, and, though little acknowledged, is at the present day performing a very important part in intellectual and industrial advancement, and will ere long effect great and unexpected changes.

The British Association.—The highly successful Dublin Meeting was brought to a close on August 21st, under the presidency of Mr. William Spottiswoode, M.A., F.R.S., LL.D., D.C.L., &c. The total sale of tickets was 2,578. Next year's meeting will be held at Sheffield, commencing August 6th.

A SCHEME FOR THE EXAMINATION OF THE GLACIAL DEPOSITS OF THE MIDLAND COUNTIES OF ENGLAND.

BY WM. JEROME HARRISON, F.G.S.,
CURATOR OF THE TOWN MUSEUM, LEICESTER.

One of the great advantages which it was hoped would result from the formation of the Midland Union of Scientific Societies, was the opportunity which it would offer to distant workers to become acquainted with one another, with a view to combined work upon the many scientific problems which our district offers to us for solution.

At the Annual Meeting of the Union, at Birmingham, on May 28th, I ventured to suggest the Glacial Deposits of the Midlands as a subject peculiarly fitted for our joint efforts, and as this idea was favourably received both at the time and since, I now venture to offer a few suggestions as to the way in which we should begin work.

I.—The Workers.—No Society can plead an absence of material on which to work. The stratified rocks which constitute what we term the solid geology of our country run in tolerably definite bands, but the glacial drift is scattered irregularly all over the face of the country, and is with us everywhere. Each Society then should appoint one of its members who should act as secretary or record keeper for the particular study we propose to attempt. The other members who are willing to aid actively in the task should give in their names to him, and he should summon meetings of such members at frequent intervals.

A chief duty of the record secretary would be to keep a large observation book, in which to enter all notes and discoveries. If this book contained plenty of guards such members as preferred it might write out the results of their own work, which could then be pasted in the book.

As it would be absolutely necessary to gain personal experience, it would probably be easy to arrange for joint meetings of all who take an active interest in this work in the various districts in turn. The typical deposits of the east and west coasts and of Scotland would also be visited and examined.

II.—The Work.—In the first place it would be necessary for each worker, or at all events each Society, to obtain the Ordnance Maps, both plain and geologically coloured, of their neighbourhood.

Upon the plain maps they should distinguish by dots and numbers the precise position of every gravel pit, brick pit, &c., where the surface deposits are well exposed. Each of these sections should then be visited in turn and carefully examined. Each should be measured, and a plan and section—no matter how rough, if fairly accurate—drawn to scale; if a water-colour sketch could be made of the principal face so much the better. In as many cases as possible an idea of the height of each point above the sea level should be obtained either by aneroid, levelling, or

computation. The dip, if any, of the layers must be noted, false-bedding looked out for, and especially in the clayey deposits any indications of *bedding* remarked. Specimens from each point must be collected. If in wooden boxes about 6in. by 4in. an average specimen of each deposit could be secured, it would be of service in comparing with other localities. The stones must be carefully examined for striations, and so also the rock surfaces below when exposed. If 100 stones are collected at random from any pit they should then be sorted according to their composition, and the proportions stated. Specimens of every variety must of course be secured for reference. Fossils must be carefully looked for. So far as I know, not one shell has yet turned up in the drift deposits of the midlands proper. Entire and large shells must not be hoped for, the smallest fragments will be acceptable, and the sand must be washed and examined microscopically for foraminifera, &c.

The large boulders will almost force themselves upon our attention. Good specimens of each measuring not less than 4in. by 3in. must be obtained, and every possible fact recorded about them. Much information may often be got from rustics and dwellers in the neighbourhood generally, and the ideas so elicited are often of the most racy description.

When an examination of the principal open sections has been completed in this way we shall be beginning to obtain some familiarity with our task, and must endeavour to connect our observations so as to make complete maps of the surface deposits, to connect, that is to say, the various exposures so as to show what deposits are present under grass-covered fields or wheat crops as well as in the gravel pits and brick pits which we can so easily examine. This is a point, however, which we can consider further on, only remembering in the meantime to make as many notes about water-supply and well sections as we can. It will be necessary to endeavour to identify the rocks of which boulders are composed so as to determine the direction in which the ice-sheet has travelled. For this purpose typical collections of Welsh rocks, of those of the Lake district, and of Charnwood Forest will be most useful. I shall be glad to forward to any one who is in want of them for this purpose a small collection of typical Charnwood specimens, and doubtless dwellers near other regions of hard and old rocks would also help in this way.

In a separate note book enter *at the time* as many particulars as possible; omit nothing however insignificant, and let each point be visited more than once, and by different workers if possible. It will be found useful to have a small number book, containing sheets of numbers, say from 1 to 1,000, gummed and perforated. When a specimen of a boulder, &c., is obtained, let a number be at once gummed on it, whilst in the note book the same number is written down with full description of locality. I have found this the best of many plans.

The apparatus required in addition to a map is not much. A geological hammer with a square head and belt with flap to carry it in; a small compass, a little acid bottle to test for carbonate of lime, a good satchel or stout gamekeeper's bag, a clinometer, a pocket lens; all these are useful, but I have known a working man with a coal-peck do

excellent work. It is a great thing to walk much, to get a thorough geographical idea of the tract of country you are about to examine. Suppose at the meeting of your "committee on the drift deposits" you with a friend have undertaken the examination of a district including, say ten square miles. Then the best thing to do is to learn this little region thoroughly, to master the course of every brook and streamlet, the position of every house and hedgerow. The number of new facts that are sure to turn up will surprise you.

A complete list of what has already been written upon the drift would more than fill one number of this magazine. "The Great Ice Age," by Mr. Jas. Geikie, (2nd edition, 24s., Daldy, Isbister, and Co.,) is an excellent book. Mr. Searles V. Wood, jun., is another high authority on the subject, to whom I am personally indebted for much kind advice. Unfortunately Mr. Wood's papers are chiefly in the "Journal of the Geological Society" or in the "Geological Magazine," but it may safely be said that no one has done more remarkable and original work in connection with the glacial deposits (chiefly of the eastern counties) than Mr. Wood. In "Geological Survey Memoirs," lately published by Mr. de Rance ("Superficial Geology of S.-W. Lancashire," 17s.) and by Mr. S. B. J. Skertchley (the "Fen-Land," 40s.) we get, of course, most reliable and interesting information, but the price of these works is to individuals almost prohibitory. Such works, however, may well be added to the libraries of all our societies. I will endeavour to review these two books in our next (October) number. In H. B. Woodward's "Geology of England and Wales" (Longmans, 14s.) there is also a good and full *resumé*.

No very special training is needed on the part of those who are willing to lend a helping hand. For instance, we want to know how far the chalky boulder clay of the eastern counties extends to the west and south, and also the relations to it of certain beds of flinty gravel and sand. Now everybody knows the appearance of a lump of chalk and a piece of flint, and we ought to be able to fix the westward extension of these beds to a certainty. I have never seen the clay full of bits of chalk in size from a pin's head upwards, at any point west of Charnwood Forest, but then I have not enjoyed many opportunities of examining the drift of Staffordshire, Warwickshire, &c. The flinty gravel appears to stretch further west, but what is its limit in this direction? Again, in the midland district we hold the key to the correlation of the deposits of the east and west coasts. It is now thought that the glacial deposits of Lancashire and Cheshire are of a later date than the "mid-glacial sands" and chalky clays of the east coast. We must endeavour to track each set of deposits as far inland as possible, and observe their relative behaviour.

With this branch of geological study is bound up the question of the origin of man. If in the Victoria Cave, near Settle, clear evidence is obtainable of pre-glacial or inter-glacial man, why should not other evidence of his presence in the centre and north of England be found?

Then in each midland county if some half-dozen workers will but band themselves together for the prosecution of this study, I see no reason why valuable results should not be attained at an early date, and the exhibition of specimens, illustrative of the glacial deposits of the Midlands, might be made a special feature of the Annual Meeting of the Union at Leicester, in 1879.

If any scheme of the kind hinted at above can be set on foot, I would suggest that the various record keepers meet at given centres, say at first monthly. They should appoint one of their number as a general secretary or reporter, and notices of the work done should appear from time to time in the pages of the "Midland Naturalist."

Finally the three questions upon which it seems necessary to fix our attention are:—

(1) Is it a right and useful thing that the scientific societies of the Midlands, having entered into a union with each other "for the promotion of the study of Natural History, and to provide opportunities for personal intercourse among their members," should place before them definite objects of scientific study for combined work?

(2) If so, is the study of the Glacial Drift a suitable object?

(3) And is the plan of work proposed in this paper calculated to yield satisfactory results?

NOTES ON MELICERTA RINGENS.

BY F. A. BEDWELL, M.A., F.R.M.S.

There is, perhaps, no animal that has been more observed and less studied than *Melicerta ringens.* To sit looking for hours at her beautiful tower in the hope of seeing her lobes appear is tantalising work; but it is really on our capacity for this patient waiting that our success in the study depends. Unless you examine Melicerta with at least a one-fourth, I know of no method of illumination which will bring out her details, while any power above two-thirds necessitates your confining her in a space so small that the lobes feel the glass sides of your minute tank the moment they come out, and then they shrink at once from the contact. Dr. Hudson, of Manilla Hall, Clifton, showed me, as long ago as 1860, how to manage such objects, and I have followed his plan ever since, and know no better. The specimen is laid in an *annulus* of thin microscopic glass, (the thinner the better because you can always double them,) the diameter of the outer circle is about $\frac{7}{8}$ths of an inch, that of the inner circle about $\frac{5}{8}$ths. You glue this ring to the ordinary glass slide, and when a piece of thin glass is laid over it you have a minute tank, which you can fill with water at pleasure by a dipping tube as the water evaporates.

It is most important that students should know what a field this and cognate rotifers offer for study, and that the subject is very far from being exhausted. The question of the male alone is nearly untouched, and, with high powers at command, it ought to be a very productive and interesting subject. I was so fortunate as to see what I believe was the male of Melicerta in last November. I was examining a very fine female specimen, which was freely out and briskly engaged, when from the tube there emerged a small free swimming rotifer. In point of size it was not quite as long as one of the larger lobes of the female; the tube of the female in length would make about six of it. It was very active, and it bent its body into most graceful and rapidly changing curves; its ciliary disk was totally unlike that of the female, its tail also was wholly unlike the female's, for while the female has a sucker foot to fix on to a weed, this specimen had a forked tail, of which it made constant use, opening the forks like pincers to nip the objects to which it attached itself. Its first action alone was enough to beget the idea of its gender. It began to woo and caress the lobes of the female in the most active and elegant manner; it seemed almost as if it was nibbling the main wreath of cilia of the female.*

Now, to any one accustomed to watch Melicerta, it must be always a matter of astonishment to see such a timid, nervous rotifer allow another to touch the cilia with impunity, but in this instance the female never flinched in any way, but accepted the attentions of the little visitor with perfect composure, and continued to feed as if quite undisturbed by its presence. The free rotifer almost immediately afterwards sailed away, and I soon lost it, though not before I had seen enough of it to conclude that had I met with it as a stranger, and not known whence it came, I should have at once set it down for one of the numerous members of the family Hydatineæ. I regret to say here that I have never contrived to attain to a knowledge of names—at least in the rotifer world—and I have always estimated an object above its name, and a fact above a new object. The desire of being godfather to a new animal is apt to lead us into fruitless paths, while the love of facts about old ones never does.

Knowing Melicerta so well, I was quite sure she would not have permitted such liberties as I had witnessed without good cause. The mere circumstance of a rotifer making its appearance from her tube was unusual, and a rotifer with a forked tail doubly so. The ordinary female egg leaves the tube in a footless and very imperfectly developed condition, while Melicerta is not an animal to allow strange rotifers to visit its tube without resentment. The time of year struck me also as special, for I had never examined Melicerta so late in the year before. Throughout last December and January, I obtained specimens from Mr. Bolton, and broke the tubes up to examine their contents, and I was so fortunate as to find ten more of the same free swimming rotifer in about fifty tubes, and under circumstances which leave little doubt in my mind as to its nature and sex. I

* The portrait of the supposed male of *Melicerta tyro*, given by Dr. Hudson (M. M. J., vol. xiv., p. 225,) is very like the male here described.

during the coming winter students who have access to them will break up with a couple of fine needles some tubes of Melicerta, they will find that a very few will contain a living female rotifer. She may have some eggs with her in the tube, but more probably she will have none. If the tube contains no female rotifer, then it will probably, in about one out of five instances, be found to contain either eggs or developed males, or perhaps both. In the very first tube I opened the female had gone, devoured by her offspring perhaps, but there were four of these free swimming rotifers. They were very lethargic, and seemed startled by my rude intrusion. One or two of them were like eggs struggling into life. I found them in every stage short of real activity, and in one or two specimens I found them incompletely developed and associated with ordinary female eggs, a fact which showed that the developed specimens were not visitors to the tubes, but were bred and born there. The way to recognise a male egg in *M. ringens* is to look for the mastax. The fact that the male has a mastax leads me to think that for a time it is in a state of growth, and that the spermatic secretions are not ripe until it has left the parent some hours, or perhaps days. It is possible that then the mastax and stomach may dwindle into insignificance, while the other organs increase in importance. The difficulty of following particular individuals will make it by no means easy to learn its whole life history. The mastax is developed very early, while the egg is in the womb of the mother. In examining some slides of dissections of the mastax of *M. ringens*, presented to me by the Rev. Lord Sydney Godolphin Osborne, and lately exhibited at the Royal Microscopical Society on the reading of a recent paper there, I found that on one slide there were six eggs, and that one of these exhibited a mastax in a forward state of development, and I believe it is a male egg. That the male should have a mastax at all is singular, as usually these males are mere spermatic bags, without mouth or stomach, very active and lively, but apparently requiring no food at all. But the mastax of the male Melicerta is very easily recognised; it differs from that of the female in being much more angular; it is shaped something like a W inverted; it is a very busy organ, and even protrudes at times from the disc itself. The facts above stated support the view that the tube of Melicerta is not only a protection to the animal when living, but harbours the eggs when the animal dies; while they also lead me to think that the time to seek the male is the end and beginning of the year.

With respect to the act of coition, that must be no doubt usually concealed by the tube, but we recognise what a delicate sense of touch these rotifers must possess, when we reflect that they are able to recognise the salutation of the suitable male, and that they permit it to have access to the tube. The remarkable disproportion, again, in the size of the male rotifers deserves attention; large male rotifers would be quite useless as they simply could not enter the tube. We see, too, that the absence of stomach and mastax in some, and the diminution of the size of these organs in others, leave room for an increased supply of the more important secretions. What Melicerta, for instance, requires as essentials in her male is a size which shall be in inverse proportion to

his capacity, and that is precisely the kind of male with which she is supplied. How she has obtained such a male, or, conversely, how such a male has obtained such a female, are important but insufficiently noticed elements in that great question of the day, which fills all our thoughts.

The whole subject of these apparently and so-called degraded males is here open before us, and it offers a wide field for observation and reflection; and the very first reflection that occurs to us is this, that, *a priori*, we have no more right to talk of degraded males than we have to talk of exalted females. What we actually see before us is a male exactly suited to the wants of the female, and able to provide her with the only secretion in the world which will enable her to continue the race, and *vice versa.* The terrible nuptials of the Queen Bee, the dying sufferings of the selected husband, the frightful slaughter of the rejected males, is a story that gives rise to some painful thoughts—thoughts which the rotifer world and its mouthless males at first sight seem sadly to confirm. For if it be true that "degradation" can bring males to such a pass, why then we see what a future may possibly be in store for other animals—for animals which are now endowed with higher powers. The bees, the ants, and the rotifers are not the only animals among whose ranks the main body of females surpass, or have a tendency to surpass, in self-restraint, intelligence, and industry, the main body of the males, and if there be any substance in the suggestion that degradation is a part of evolution, and that evolution is the principle by which "life changes" and "life progress" are conducted, why, then, a hideous future may be in store for some of the more highly-organised races; when appetite becomes the ruling force, it is developed at the expense of intelligence, and the male must inevitably degrade, and must either drag the female with him, and so obliterate both, or sink below her in intellectual capacity.

But here I must confess myself altogether a heretic, and for my own part I believe that, so far as the question before us goes, neither degradation nor evolution had anything to do with the present state of the bee or the rotifer world. I am of the mind of Falconbridge as to his parentage. "Evolution could do well," but it could not get a suitable male for a female without the aid of an outer independent and far higher principle than that which is involved in the word development. To me the male rotifer is what it is, that is to say, a diminutive spermatic bag, simply because it was of the utmost importance to the race that the male should have one object in life, and only one, and that it should not waste time in seeking and devouring food in an hour when the continuance of the race requires that it should be engaged otherwise. The "replenishment" of the earth, the multiplication of stock, runs like a marvellous thread of exquisite and infinitely varied contrivance through the whole series of living beings, and the microscope greatly intensifies the marvel. The difficulties which lie in the way of treating, without offence, this subject of male and female has made it popularly a neglected topic, and thus the world at large has missed the strongest argument which, to my mind, there is against

the theory of development. As a complete creative, productive agency, I altogether disbelieve in evolution—as a separator of species, as a destroyer of thousands of forms that cannot all live, and so as a probable selector of what shall survive out of the million possible products of God's higher creative, productive laws, whatever those laws are, I accept and believe in the theory which is known by this name, but no further can I trust or follow those who trust and follow it, and amongst other reasons because *Melicerta ringens* and its suitable male will not allow me to do so.

NATURALIST FIELD CLUB EXCURSIONS.

BY THE REV. J. D. LA TOUCHE, B.A.,
PRESIDENT OF THE CARADOC FIELD CLUB.

Field Clubs are now in full work. Long days, sunny weather, nature clothed in bright and varied hues, all combine to call forth those whose souls are stirred with any higher aims than to follow the mill round of daily work and add to their daily store; all invite us to come forth from desk and study, from workshop and counter, to explore the marvels which a good Creator has prepared to instruct and cheer and elevate our souls. It may, therefore, be not unsuitable at such a time to consider a few of the objects which we place before us in our excursions, with a view to rendering them more useful for their professed purpose. And first, I would remark that Field Clubs are apt to err in two opposite directions in either proposing too much for themselves or too little. With the model before them of the British Association and other great societies, of which the members are the primates and leaders in scientific research, they are, especially on starting, inclined to fancy that they can in some way emulate the proceedings of these learned bodies. Accordingly the work they cut out is often on too extensive and ambitious a scale, and in a short time breaks down. I have been present at the inaugural meetings of such societies when the elaborate rules and bye-laws adopted contemplated a scale of operations which it was manifestly impossible could ever be attained. And this soaring ambition, the not unnatural ambition of early youth, is very apt in more mature years to relapse into the opposite extreme, when serious effort is virtually abandoned, and the so called Naturalist excursion becomes a mere pic-nic, pleasant and useful enough in its way, but having little relation to the objects for which the club was started. Nor should it be overlooked that this *dilettante* kind of work brings science into contempt, and not unfrequently have kind critics suggested a comparison between the proceedings of the Field Club and those of the immortal Pickwick and his friends.

If these societies are to attain what their members would desire, if they are to add anything to the stores of science, their aim must be more modest, practical, and definite. First, with respect to the work cut out for the excursions. It is not often that this can be of the thorough and laborious nature which individuals or very small parties can undertake.

The leaves of the stone book cannot be turned over by the geologist to any good purpose in a few moments. The trunks of old trees, swamps, and brakes are not likely to yield up their treasures to the botanist on a cursory glance. Time and diligent research and scrutiny are essential to secure these prizes. But time generally fails where a large party has to be guided from point to point. The most that can be expected on such occasions is to obtain a more comprehensive view of the surface of a district, and sometimes to listen to an exposition of its features from those who are well acquainted with it.

Secondly, a vigorous effort should be made for the production of original papers. Field Club meetings are favourable opportunities for those members who have devoted themselves to any branch of science to make known the results of their researches. There are few bodies of men among whom some are not to be found who are quite competent to do this, and one of the most valuable functions of the society is to elicit any local information which they may be able to supply.

Thirdly, the formation of local museums, or the addition to those which already exist in the neighbourhood, may well occupy the attention of our members. Of course some districts are much more favoured in this respect than others. But the very existence of a field club implies that of objects worth observing and collecting, and nature may truly be said to be inexhaustible in supplying them.

Lastly, I would suggest the importance of each club taking up some definite line as an object for its energies and researches. The example in this respect of the most distinguished and successful of the clubs in the West of England may be studied with advantage. While prosecuting a variety of the ordinary subjects usually proposed by such bodies, the Woolhope Club for several years made it their chief aim to record and describe the trees of Herefordshire; and in their transactions—an extensive and very interesting series of volumes—many photographs and interesting papers have appeared descriptive of those which are remarkable for their size, age, or history. Here was a subject in which everyone could take part, and though at first sight it might appear of but limited range and not very important, yet it was soon evident that it led to observations of great and varied interest; for everyone who has entered on almost any investigation with ardour and perseverance must have remarked that, as he goes on, many unexpected paths branch out into allied subjects, each of them supplying abundant material for further research. In this case the mere attempt to record the height, the girth, and other conditions of remarkable trees led to observations on their botanical varieties, to the comparative hardness and durability of timber, to many historical facts connected with them, and, in some instances, the progress of geological events has been indicated by noting the change in the course of a river proved by the existence of some old tree that once grew on its banks, but from which it has now far receded. The Woolhope Club has since made the study of the fungi, especially with reference to their usefulness as articles of food, their chief pursuit; and their annual Fungus Forays, and exhibitions and dinners at which the products of the chase are served for experimentation

on the palates and digestion of their enterprising but adventurous members, are well known not only in England, but throughout Europe. They have lately added to these the description of varieties of apples and pears, and will doubtless attain the same success in this branch of study as has attended their efforts in others.

A subject which might with much advantage be taken up by any club, and which is within the reach of any one of ordinary observation, is that which goes by the name of Teratology, or a record of abnormal growths in plants and animals. The appearance of such unusual forms has been made much use of by our great physiologists to solve some of the most interesting problems in the science of development and generation. When intelligently correlated with other facts, they often supply links now lost, and explain the use of organs and the connection between the successive races of creatures which have from time to time existed in the world. To read these phenomena rightly, to put together the disjointed members of the puzzle, is indeed within the power of but few, as it is perhaps one of the highest functions of which the human mind is capable; but the more humble task of recording them is one which anybody might undertake, and would seem to be a very appropriate and feasible object for the members of clubs to propose to themselves; in doing so they might hope to materially promote the cause for which they exist, since there can be no doubt that large numbers of facts of this kind, which if known to a Darwin or a Huxley would be made of the greatest use, are lost to science from the want of observation and of record. As a guide to this branch of research, a volume on Teratology, by Dr. Masters, published by the Ray Society, has been highly recommended.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF JULY, 1878.

BY. W. JEROME HARRISON, F.G.S.

The rainfall of July presents several interesting features. It is generally below the average, and greatly so in the few places which escaped the severe thunderstorm of the 24th. The return from Cromford of one rainy day only in July was so extraordinary that I wrote specially to Mr. Tissington, who replies, "I beg to say that my return for July is quite correct. I heard of rain falling within a few miles of here, but unfortunately it did not reach us." The dry period, which commenced on June 18th, lasted till the 24th of July. Up to the 17th of the latter month the weather was warm, but the sky cloudy, with a prevalence of north-westerly winds. From the 17th to the 22nd the heat was intense, the thermometer rising daily to above 80°. On the 23rd the temperature fell suddenly, and the next day a succession of thunderstorms visited almost every point in the Midlands, producing the maximum and only important rainfall of the month: in the neighbourhood of Coventry, nearly 2½ inches fell in as many hours. At Coston Rectory, the lightning in this storm was noted as being very vivid, and of a remarkable rosy hue. Afterwards fine weather, but with a lower temperature, prevailed to the end of the month.

STATION.	OBSERVER.	RAINFALL. Total for M. In.	Greatest fall in 24 hours. In.	Date.	No. of rainy d.	TEMPERATURE. Greatest ht. Deg	Date.	Great'st cold Deg	Date
GLOUCESTERSHIRE.									
Cainscross, Stroud	W. B. Baker, Esq.	1·85	1·23	24	9	110·	20 & 21	44·0	22
Cheltenham	R. Tyrer, Esq.	2·06	1·61	21	7	84·8	19	39·5	30
Stroud	S. J. Coley, Esq.	1·92	1·11	24	8	81·0	19	49·0	27 29 30
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	1·30	1·07	24	7	79·0	20 & 21	45·0	4
Whitchurch	A. B. George, Esq.	1·04	·60	23	5	80·0	19	54·0	24
Woolstaston	Rev. E. D. Carr	·90	·70	21	5	84·0	20 & 21	46·0	14
Leaton Vicarage, Shrewsbury	Rev. E. V. Pigott	2·02	1·64	24	9	86·0	20	41·0	9
More Rectory, Bishop's Castle	Rev. A. Male	1·31	·91	24	8	86·0	20	40·0	23
Larden Hall, Much Wenlock	Miss F. R. Boughton	·96	·68	24	6				
Bishop's Castle	E. Griffiths, Esq.	1·10	·65	24	8	88·0	21	43·0	4
Cardington	Rev. Wm. Elliot	1·05	·79	24	5				
Adderley Rectory	Rev. A. Corbet	1·08	·49	24	10				
Stokesay	Rev. J. D. La Touche	2·05	1·26	24	5	86·5	21	41·7	31
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	·81	·26	24	10			39·0	4
Stoke Bliss	Rev. G. E. Alexander	1·34	·82	24	5	83·0	20	47·0	13
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq.	2·16	1·47	24	8	85·7	17	41·2	4
West Malvern	A. H. Hartland, Esq.	2·26							
Pedmore	E. B. Marten, Esq.	·29	·10	25	6	90·0	21	47·0	3 4 12
Stourbridge	Mr. J. Jeffries	·46	·20	22	6	86·0	16	42·0	12 31
St. John's, Worcester	G. B. Wetherall, Esq.	1·82	1·43	24	6	84·0	22 23 24	39·0	
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	·78	·29	24	6				
Amblecote	Mr. J. Robins	·26	·09	22	6				
Dudley	Mr. J. Fisher	·50	·15	25	9	94·0	21	46·0	3
Sedgley	Mr. C. Beale	·41	·13	7	9	85·0	21	42·0	3
Kinver	Mr. W. H. Bolton	·45	·17	22	5				
Walsall	Mr. N. E. Best	·67	·32	24	8	87·0	19	48·0	3 12 31
Patshull Gardens	Mr. T. W. Dell	1·72	1·40	25	8	86·0	21	41·0	13 & 31
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	1·10	·67	24	9	94·0	21	43·0	4 & 31
Wrottesley	E. Simpson, Esq.	·61	·38	24	6	86·0	22	46·3	4
Tamworth	W. Arnold, Esq.	1·25	·48	25	10				
Tean Vicarage, near Cheadle	Rev. G. T. Ryves	2·09	1·14	24	8	84·5	19	42·0	13
Heath House, Cheadle	J. G. Philips, Esq.	1·76	·98	24	9	85·0	21	47·0	4 13 28 31
Alstonfield Vicarage	Rev. W. H. Purchas	·62	·25	24	8	83·4	21	40·6	13
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	2·90	2·48	24	9	84·0	19	50·0	3 & 12
Coventry	J. Gulson, Esq.	2·81	2·36	24	7	79·0	20 & 21		
Bickenhill Vicarage	Jos. Ward, Esq.	1·18	·42	24	6	86·0	31	48·5	31
St. Mary's College, Oscott	Rev. S. J. Whitty	·66	·26	24	5	88·2	21	47·1	13
Henley-in-Arden	T. H. G. Newton, Esq.	.99	·50	25	10	88·0	19	46·0	24 28 29 30
Rugby School	Rev. T. N. Hutchinson	1·00	·68	24	7	84·4	21	44·2	4
DERBYSHIRE.									
Buxton	E. J. Sykes, Esq.	1·76	1·1	24	11	79·9	21	40·4	13
Stoney Middleton	Rev. U. Smith	1·26	·39	24	8	83·0	20	35·0	13
Fernalope, Belper	J. G. Jackson, Esq.	·52	·38	24	8	86·0	20	44·0	4
Matlock Bath	R. Chadwick, jun., Esq.	·57	·45	24	4	79·0	21	41·5	4
Linacre Reservoir, Ches'field	C. E. Jones, Esq.	·61	·28	24	8				
Brampton S. Thomas	Rev. J. M. Mello	·67	·30	24	7	89·2	20 & 21	42·1	13
Willesley Gardens, Cromford	J. Tissington, Esq.	·17			1				
Stuffynwood Hall	Mr. R. Rolfe	1·50	·94	27	8	89·0	19	43·1	3
Spondon	J. T. Barber, Esq.	·88	·51	24	9	80·0	19 20 21		
YORKSHIRE.									
Tickhill, Rotherham	B. J. Whitaker, Esq.	1·46	.84	23	9	87·0	21	42·1	4
NOTTINGHAMSHIRE.									
Hodsock Priory, Worksop	H. Mellish, Esq.	1·06	·67	27	8	84·2	18	40·	4
Grove House, Mansfield	W. Tyrer, Esq.	1·08	·40	27	9	86·2	19	41·1	4
Tuxford	J. N. Dufty, Esq.	·98	·40	27		90·0	20	46·0	12
Highfield House, Nottingham	E. J. Lowe, Esq., F.R.S.	2·60	2·21	24		91·0	19	41·4	4
Park Hill, Nottingham	H. F. Johnson, Esq.	1·54	1·05	24	6	88·6	21	49·0	3 & 12
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	1·47	·89	24	8	86·5	21	41·2	4
Ashby Magna	Rev. E. Willes	1·02	·52	24	7	88·0	19	46·	12
Market Harborough	S. W. Cox, Esq.	·97			4	81·0	19 & 20	39·0	3
Kibworth	T. Macauley, Esq.	1·45							
Town Museum, Leicester	W. J. Harrison, Esq.	2·14	1·21	24	8	84·0	21	42·9	4
Belmont Villas, Leicester	H. Billson, Esq.	2·02	1·25	24	7	86·5	20	45·8	12
Syston	J. Hames, jun., Esq.	2·05	1·22	24	10	95·0	22	42·4	4
Waltham-le-Wold	E. Ball, Esq.	1·21	·94	24	7	84·0	20	44·0	1
Little Dalby Hall	G. Jones, Esq.	1·59	·81	24	9	94·0	19	41·0	4 & 13
Coston Rectory, Melton	Rev. A. M. Rendell	1·43	1·11	24	8	81·8	21	35·1	4
Belvoir Castle	W. Ingram, Esq.	1.89	·75	24	8	87·0	22	38·0	4
Foxton Locks	Union Canal Company	·84	·38	22	5				
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	0·83	·60	24	6				
Castle Ashby	R. G. Scriven, Esq.	·73	·42	22	6	84·0	19	42·0	4
Sedgebrooke	C. A. Markham, Esq.	·59	·19	24	8	86·0	21	38·0	4
Kettering	J. Wallis, Esq.	1·25	·46	27	7	82·0	22	48·0	4
Althorpe	W. F. Jakeman, Esq.	·62	·35	24	4	84·0	20	41·0	3
Northampton	H. Terry, Esq.	·45	·19	22	6	86·0	19	47·0	3
RUTLAND.									
Burley-on-the-Hill	W. Temple, Esq.	1·75	·45	25	7	85·0	18	45·0	3
West Deyne, Uppingham	Rev. G. H. Mullins	1·26	·62	24	7	86·8	19	44·8	4
Northfields, Stamford	W. Hayes, Esq.	1·06	·90	24	5	82·0	20	47·0	13
Radcliffe Observatory, Oxford	Mr. H. E. Bellamy	1·13	·66	24	7	84·3	19	46·7	3
Spital Cemetery, Carlisle	T. Bell, Esq.	·34	·27	5	11	82·4	21	40·0	12
Altarnun Vicarage	Rev. G. Tripp	1·59	·40	27	14	86·0	20	44·0	1 29 31

The barometer, with the exception of one drop accompanying the thunderstorm alluded to above, was uniformly high and steady, and there were no strong winds. Many reports speak of the excellent hay harvest, which was secured in good condition. The corn, too, improved greatly. Oats were cut at Waltham in the last week of the month, and barley near Nottingham on the 23rd.

Of direct solar heat, measured by a thermometer with blackened bulb, in a vacuum, we had at Spondon, 158° on the 20th, and 153° on the 21st, 144·8° at Cheltenham on the 20th, 144° at Leicester on the 20th, 138·2° at Loughbro' on the 20th, and 133° at Buxton, also on the 20th. Thick night mists with heavy dew are reported from Rotherham, during the middle part of the month, "owing, doubtless, to the drought of nearly five weeks."

Correspondence.

WHERE ARE THE BUTTERFLIES ?—May I ask our Entomological friends what has become of the "Diurnal Lepidoptera" this year? I have scarcely seen a butterfly here, not even a white one. Were they destroyed by the wet May, and has their absence been noted in other counties ?—UMBRELLA NET, Leicester, August 18th.

CRISTATELLA MUCEDO.—On the 15th of August, for the first time this year, I found the rare and beautiful Polyzoa, *Cristatella mucedo*, near Birmingham. On that day I found only three specimens, although searching for over two hours; but on the 22nd I found them in great abundance, and full of their elegant statoblasts or winter eggs. I am preparing a reduced copy of Professor Allman's drawing of this object, from his admirable Monograph on the Fresh-water Polyzoa, which I hope to send out to my correspondents, together with the living objects if they should survive long enough.—THOMAS BOLTON, 17, Ann Street, Birmingham, August 24th, 1878.

SNIPE BREEDING.—As instances of the snipe breeding in this district are, I suppose, rare, it may interest some of your readers to know that about a month or five weeks ago I saw in this neighbourhood a nest of the full snipe with four eggs in it. My friend who pointed it out to me was fortunate enough to see the bird on her nest. This I did not do. She has since hatched out her young safely. Soon after seeing the nest I flushed a snipe on some hill ground, about a mile from the first-named locality. Whether this was the male bird feeding, or whether it betokened another breeding couple of course I cannot say.—WM. ELLIOT, Cardington Vicarage, Church Stretton, Aug. 9th, 1878.

THE CUCKOO, &c.—The double note of the cuckoo is not uncommon, but the same cuckoo does not change from the single to the double note. The bird which says cuck-cuck-oo never says cuck-oo. There was a cuckoo with a double call which came here regularly for several years, and from the first day of its arrival to the day of its departure it always used the double call. In this neighbourhood there is now a great scarcity of cuckoos, and this has been the case for several years. It seems desirable to record the alterations in the number of animals, birds, &c., from year to year. There is a great increase in the number of moles, rats, wood pigeons, toads, frogs, and field mice, and a great falling-off in the number of landrails, cuckoos, dragon flies, wasps, and grasshoppers. An epidemic has killed many field mice and fowls in this neighbourhood.—E. J. LOWE, Nottingham.

Cuckoo.—Your correspondents, in answer to "N.'s" enquiry in the July number of "The Midland Naturalist," regarding the note of the cuckoo, concur in stating that the frequent repetition of the first part of its note is very common. Such is my own observation; but is not Mr. J. R. Thompson mistaken in saying that this only occurs just before the bird is about to leave us, as I have frequently noticed the circumstance soon after the cuckoo's arrival in May? At the former-named period, however, its note is often very hoarse and peculiar, much like the sound produced by the trumpeter pigeon. The question of the cuckoo's incubation is a more important and interesting one. It is, I fancy, quite unique in the habit of depositing its egg in the nest of another bird, and this invariably an insectivorous one—usually a wagtail or a hedge-sparrow. It is sometimes asked how can this be managed, where the nest, as often happens, is in such a position as to make it impossible for the cuckoo to go in and lay its egg like any other bird? I am assured that the egg is first laid and then conveyed to its destination in the cuckoo's mouth or throat. An accident, which lately occurred near here, seems to confirm this explanation of the difficulty. A cuckoo flew against a plate-glass window and fell stunned by the blow. It was taken up and a little water sprinkled on it to revive it, when it was seen to vomit an egg, apparently from its throat. It then soon recovered, and was set at liberty. A few days later a cuckoo, possibly the same bird, was observed clinging to a mass of jasmine close to the same spot, and an egg was deposited in a water-wagtail's nest, situated within the bush. A young cuckoo was soon afterwards hatched and reared there by the wagtails, and was an object of much interest to the inmates of the house during its growth and after it had left the nest, being, apparently, tended with the greatest solicitude by its foster parents. Can any of your readers supply further information on this subject?—Arthur S. Male, More Rectory.

An Apple Tree in my garden, bearing fruit, has this week put out blossoms on one branch, a thing I never observed at so late a date before. Wm. Elliot, Cardington Vicarage, Church Stretton, Aug. 9th, 1878.

Mirage, seen by Capt. A. E. Lawson Lowe, (from the camp of the North Durham Militia, at Redcar.)—Capt. Lowe writes:—"This mirage occurred on July 19th, 1878, on an intensely hot day, (the temperature said to be 96° in the shade,) a little before six in the afternoon. Looking towards Hartlepool, (about six miles off,) the distance being particularly clear, every object in the town was distinctly visible. About a quarter of an hour later a slight haze seemed to rise along the sea line, stretching quite across in front of Hartlepool, and when next I looked the whole town was reflected upside down in the sky. Every object was exactly reproduced in a reverse position up to a certain height, where the mirage was cut off by a clearly defined line, above which was the blue sky. Exactly in front of Redcar, out at sea, the ships were not reversed, but appeared distorted, their masts and sails being carried up, as it were, to twice their actual height. More to the right the ships appeared reversed in the same manner as was the town of Hartlepool; and at the extreme right, besides the reversed ships, each vessel had a shadowy representation of itself at a little distance to the right. The phenomenon lasted about ten minutes. Several of the officers were out fishing at the time, about a mile and a half from shore, and although they noticed the line of haze, the mirage was not visible from where they were."

Agave Americana (the American Aloe.)—Two of these rarely flowering plants have this year bloomed in the conservatory at Sudbourne Hall, Wickham Market, Suffolk, the seat of Sir Richard Wallace. The plants are about 24ft. high, with branches very short and thickly set

together at the top of the stem, farther apart lower down, and not opposite one another; the flower-branches do not grow near the leaves, but are quite 3ft. above them. There were thirty-two branches, and taking each truss to average eighty blossoms, there were about 2,700 flowers on one plant. The flower buds look a pale greenish white, tipped with bright yellow; the flower lasts from three to four days. The scent is most disagreeable; an immense quantity of honey drops from the flower. The thickness of each leaf next the stem is from 6in. to 8in.; the width of leaf at the base is over a foot; length about 6ft. The leaves are dark green, with stripes of yellow round the edge. These plants are said to have been in the conservatory nearly eighty years. As soon as the flowers expand, the leaves begin to droop, and the plants gradually die away. The dry stem of a plant, that flowered about eight years since, is preserved in two pieces in the conservatory; and although nearly 27ft. long, can be easily carried about by a lady or child, being as light as a piece of cork.—R. M. S.

Geology of Shropshire.—Dr. Callaway having referred, in "The Midland Naturalist" for August, (p. 206,) to some criticisms of mine on his paper in the "Quarterly Journal of the Geological Society" for November, 1877, I may be allowed to say that these were founded on a misapprehension of his words as reported in the discussion on his paper. I find him saying there that "the shales are one homogeneous formation marked throughout by the same fossils, the younger types occurring in the same beds with the older forms, and mixed indiscriminately with them. In the lower part of the upper series also, there are no signs of transition into an older fauna, the species being common Caradoc forms." At a recent excursion of the Caradoc Field Club to Pedwardine, Dr. Callaway explained that he here referred to two distinct strata, in the lower of which Tremadoc forms are found without intermixture with those of Caradoc age.—J. D. La Touche, Stokesay, Craven Arms, Aug. 6th, 1878.

Gleanings.

The Reindeer in the Midlands.—An antler of the Reindeer *(Cervus tarandus)* has lately been found in the gravels of the Soar, near Leicester. The perfect portion is 2½ft. long, and 5in. in circumference at the beam. It is now in the Leicester Museum, which possesses another antler, and also a fine tusk of the Mammoth from the same deposits. These large bones seem always to occur at or near the base of the river-gravel, (here 10ft. to 17ft. thick,) resting upon the Keuper Red Marls.

Pond Life Collector's "Condensing" Bottle.—Mr. T. Bolton, of 17, Ann Street, Birmingham, has showed us a good form of "condensing" bottle, (price 3s.,) which collectors of pond life will find a most convenient addition to their apparatus. The water as taken from a pond is poured through a long-necked funnel into a bottle, of which the exit pipe is terminated inside by a wire cage covered with fine muslin. By help of this apparatus the living animalcules in a considerable quantity of water can be rapidly condensed into a small bulk, and so conveniently carried home.

Rev. W. B. Clarke, born 1798, (Suffolk,) died 1878 (Sydney, N.S.W.) Mr. Clarke was the "Father of Australian Geology." He went out in 1839, and was among the first, if not the first, to recognise the existence of gold in the Australian Continent. He was also the discoverer of diamonds and of tin there. An idea of his work may be gained from the fact that he is said to have officially reported on no less than 108,000 square miles of territory.

ENTOMOLOGY.—A good list of books on Entomology, now on sale, has just been issued by Mr. W. Wesley, 28, Essex Street, Strand, London, W.C.

W. C. HEWITSON, born 1806, (Newcastle-on-Tyne,) died 1878. Of this deceased Naturalist an interesting memoir appears in the *Entomologist* for July. He was famous for the exquisite delineation and careful colouring of his illustrations of British Oology and of the Diurnal Lepidoptera. He has left his magnificent collections to the nation, but his library, with £3,000, to the Natural History Society of his native town.

THE GEOLOGICAL SURVEY.—The new catalogue of the Survey publications has been lately issued, and may be obtained from any of the agents—as Longmans, Paternoster Row; Stanford, of 55, Charing Cross, &c. Many works are reported as "out of print," such as "Jukes on the South Staffordshire Coalfield," "Ramsay's North Wales," &c. Surely, some efforts should be made to bring these up to date. Among new works marked "nearly ready" we note "Skertchley on the Manufacture of Gun-Flints," &c., (which, we expect, will prove most interesting to all who are engaged in the study of pre-historic man,) and a big book by Prof. Green and his colleagues on the "Geology of the Yorkshire Coalfield." It will be interesting to note the price at which the latter will be sold, after the experience we have had lately.

DEEP WELL-BORING AT HOLKHAM HALL, NORFOLK.—We are indebted to Mr. W. Whitaker, F.G.S., for the details of this successful undertaking.

		Feet.
	Gravel	20
	Chalk with flints	519
	Chalk without flints	116
	Red marl ("red chalk")	8
	Blue gault	10
Neocomian, 70ft.	Hard sandstone	½
	Sandstone	14½
	Green sand	8
	Sand ?	39
	Soft carstone	3
	Hard carstone	5

An abundant supply of water was obtained, 540 gallons per minute having been pumped. Holkham Hall is thirteen miles east of Hunstanton, where the red chalk crops out in the well-known cliff, but at the latter point the gault is absent.

Reports of Societies.

BURTON-UPON-TRENT NATURAL HISTORY & ARCHÆOLOGICAL SOCIETY.—The members made an excursion to Wichnor and Alrewas, on Saturday, July 20th, under the leadership of Mr. T. C. Martin, hon. sec. At Alrewas Church they were joined by a number of members of the North Staffordshire Naturalists' Field Club. The church, a very interesting building, was fully described by Mr. A. Scrivener. The register contains entries as early as 1547. Wichnor Hall, the seat of Colonel Levett, was next visited, where luncheon had been hospitably prepared for the visitors. Wichnor Hall was an object of great interest from its historical associations, the curious nature of its tenure, and the many rare objects of various kinds carefully preserved in it. After passing through the Park the Church was visited. Cordial votes of thanks were given by the two societies to Colonel and Lady Jane Levett for their hospitality and kind reception.

CARADOC FIELD CLUB.—The second Field Meeting was held at Brampton Brian, July 18th. A paper was read at Coxwall Knoll, by the Rev. C. Burrough, supplementary to one read last year at the Gaer Ditches, maintaining the claim of that locality to be considered the scene of Caractacus's last battle. The President read a paper at Brampton Brian Castle, containing extracts from the letters of Lady Brilliana Harley, who was besieged there. Subsequently Dr. Callaway gave an address at Pedwardine on the place of the beds exposed there in the system which his recent investigations have been elucidating. The members dined together at the Craven Arms Hotel.

DUDLEY AND MIDLAND GEOLOGICAL AND SCIENTIFIC SOCIETY AND FIELD CLUB.—The fourth field meeting for the year was held at Rugby, on Thursday, July 18th. Excellent arrangements were made by Mr. Hutchinson, Mr. Wilson, Mr. Oldham, and others, of the Rugby School. With the help of various vehicles a long round was accomplished on the borders of the Lias district. After visiting two clay-pits showing good typical sections of the Lower Lias clay overlaid by quartzose and flinty drift, the surface of the clay being in wave-like undulations, sometimes folded over like a crested breaker, the magnificent sections were examined in the Victoria Hydraulic Lime and Cement Works, where great interest was excited by finding some Saurian bones near a fine head which had been removed a few days previously. After gathering numerous fossils and getting a hasty view of the cement-making process, the way was taken through Holbrook Park to Holbrook Grange, the residence of C. M. Caldecott, Esq., who had kindly arranged on the lawn many fine specimens of bones found in the neighbourhood, some of which are figured in Dr. Buckland's "Reliquiæ Diluvianæ." Many other interesting curiosities were also seen, including flexible sandstone and rare agates, some of which were presented for the society's museum at Dudley. After passing the remains of old Boughton Hall, King's Newnham Lime Works and a weak chalybeate bath were visited, and good specimens of the upper part of the White Lias were secured, with marks of boring insects as evidence that they once formed the surface. This surface is now covered with Lower Lias *Planorbis* shale, and this again by red glacial clay, the reasons for the irregular junction of these causing some discussion. After a peep at Newbold-on-Avon Church, a walk through the churchyard led to the Newbold Lime Works, where a very fine section of contorted Lower Lias limestone and shales was seen. Returning to Rugby a welcome luncheon was found set out in the Town Hall for greater commodiousness. Dr. Fraser, the President, thanked those to whom the Society were so much indebted for the day's programme, and then, by permission of Dr. Jex-Blake, the School was visited, where, besides the class rooms, chapel, and houses, and the magnificent close which always has an interest all its own on a half-holiday afternoon, special interest was taken in the Museum and the model of the neighbourhood in course of construction, and a good collection of fossils and other objects, and also in the baths and gymnasium, but particularly in the observatory, where members lingered over the valuable instruments used for some of the more abstruse investigations in Astronomy. Equally good arrangements had been made for an afternoon ramble in the opposite direction of Hillmorton, where some more clay-pits, and especially a clay-pit and sand-pit near together with a probable fault running between them in a singular manner were to be seen, also a cutting for widening the railway, by the "Steam Navvy," in a glacial re-formation of Lias; and the Church standing on a sort of island in the midst of deep peat. All these were most attractive objects, but want of time prevented the ramble, although it has since been done by some of the members. The Chester field day and visit to Salt Mines at Northwich promises much interest, and the help of many local residents has been promised. It has, however, been found necessary to postpone it from September 10th and 11th to September 17th and 18th.

EVESHAM FIELD NATURALISTS' CLUB.—An excursion of the Club took place on Wednesday, August 14th, to Buckland, near Broadway. The following botanical specimens were taken during the afternoon:—*Epipactis palustris*, *Vitia sylvatica*, *Campanula trachelium*, *Polystichum aculeatum*, *Aspidium Filix-fœmina*, and *Scolopendrium vulgare*.

NORTHAMPTON NATURAL HISTORY SOCIETY.—The June excursion to Rothwell, Rushton, and Lamport proved a very enjoyable one. The party first visited the gardens and grounds of Rushton House, in which is situated the Triangular Lodge where the conspirators met to concoct the Gunpowder Plot. The wilderness used to be the habitat of the fly orchis, but this was searched for in vain. Rothwell Church and Market House were then visited, the *miserere* seats in the former being very curious. After a pleasant drive through the Harrington Valley and Orton to Foxhall, near which occurs the almost sole piece of bogland left in Northants, the botanical section eagerly searched over this ground, which yielded among other plants, *Pinguicula vulgaris*, *Eriophorum angustifolium*, *Carex pulicaris*,* *C. stellulata*,* *C. flava*,* *C. fulva*,* *Carduus pratensis*, *Pedicularis palustris*, *Pimpinella magna*, *Gymnadenia conopsea*, *Orchis latifolia*, *Ophioglossum vulgatum*, *Molinia cærulea*,* *Triodia decumbens*,* *Valeriana dioica*, and a very rare plant, *Blysmus compressus*.* In the hedgerows, nearer Mosely Wood, *Rosa tomentosa*, *R. micrantha*, and *R. Doniana* occur. Rejoining the photographic section at Foxhall the party proceeded to Lamport, noticing on the way *Festuca myurus*. At Lamport the grounds of Sir Charles Isham afforded some pleasant rambles, the rockeries being covered with some interesting Alpine plants. The rectory pond is said by Rev. J. M. Berkeley to yield *Acorus calamus*. [Plants marked thus * are not included in "Topographical Botany."]

OSWESTRY AND WELSHPOOL NATURALISTS' FIELD CLUB AND ARCHÆOLOGICAL SOCIETY.—Fourth Excursion, August 12th.—The Club met at Lydham Heath Station, and proceeded to Linley Hall, the residence of Jasper More, Esq., which is approached by a fine double avenue of oaks, a mile long. At the top of the avenue is the site of a Roman villa. The park is very beautiful, and there is another fine avenue of beeches two miles in length; the old archery practice ground of the Norman soldiers, called The Butts, was also visited. It consists of two large mounds, eighty yards apart. The party then went on to the Stiperstones, the second highest hill in Shropshire, 1,759ft. high. Some of the party visited a quarry on the Shelve Hill, and found specimens of *Dictyonema sociale*, and a species of Graptolite, and also of Bellerophon. Amongst the plants found were *Campanula patula*, *Artemisia absinthium*, and *Vaccinium vitis-idæa*.

SEVERN VALLEY NATURALISTS' FIELD CLUB.—On August 6th, forty-five members and friends visited Ellesmere. The Great Western train landed them at Whittington Station, whence, inspecting *en route* the picturesque ruins of Whittington Castle, they drove to Ellesmere. Here they walked to the Bowling Green on the site of the old Castle mound, and thence along the side of Ellesmere, then to Otcley Park, where, by kind permission of the owner, S. K. Mainwaring, Esq., they were able to enjoy a walk through the lovely gardens and grounds. After luncheon under the trees in the park, the walk was resumed by Newton Mere and Kettle Mere to Colemere, Blackmere being also seen on the way to Whitemere. This part of the day's proceedings was interfered with by heavy thunder rain, which, however, ceased when Whitemere was reached, and a fine drive was enjoyed to Rednal Station. The explorations of the botanists were cut short by the weather, but the Rev. W. A. Leighton directed attention to a singular phenomenon which occurs in Ellesmere at this season, and was then taking place. It is locally called the "breaking up of the water," which resembles the turbid state of boiling wort. "The innumerable minute bodies in motion causing this appearance, are (said Mr. Leighton) composed each of a central agglomeration of spherical cellules, from each of which cylindrical filaments radiate in every direction. These filaments are broader near the central globule, and are attenuated gradually towards their apices, and are divided into short uniform cells, separated by distinct septa or joints, the cells being filled with chlorophyll of a glaucous or verdigris green colour. The mode in which this minute plant reproduces itself has not been observed, but it is not improbable that some sort of conjugation takes place as in the conjugate confervæ, when the chlorophyll of two adjacent cells is united into a third or new cell, which forms the winter spore. These winter spores are doubtless the central spherical cells above mentioned, which sink to the bottom of the lake and remain there dormant till August, when they rise to the surface, and germin-

ation takes place by throwing out the radiating filaments which eventually again produce the sporangia which sink as before mentioned. This little alga is well figured in English Botany, tab. 1378, under name of *Conferva echinulata* from specimens sent in 1804 from a lake in Anglesea. Its proper systematic place is in Roth's genus *Rivularia*." At Colemere and Whitemere Mr. Leighton also pointed out the singular green "Moor Balls," which are found in abundance at the bottom of these lakes, and in Alpine lakes, in North Wales, and in other counties. "They consist of an articulated Conferva, (said Mr. Leighton,) which, by the action of being rolled about the bottom of the lake by winds and currents of water, forms rounded agglomerations, varying in size from a walnut to a cricket-ball." Mr. Leighton also observed on the stonework and steps of the terraces at Oteley, large masses of dense black stains, some of which he scraped off, and on microscopic examination at home, found it to be a collemaceous lichen, termed *Synalissa picina*, Nyl., which has never before been detected in Great Britain.

SHROPSHIRE ARCHÆOLOGICAL AND NATURAL HISTORY SOCIETY.—The members had a very pleasant summer excursion on July 8th. The first point of interest visited was Tong Church, the Hon. and Rev. J. R. Orlando Bridgeman acting as conductor to the party. It contains some interesting monuments, chief among which is an alabaster one to the memory (it is supposed) of Sir Richard Vernon and his lady, and another to the memory of Sir Thomas Stanley, on which are the lines commencing "Not monumental stone preserves our fame." Donington was next visited. The church there is now being restored. The Rector, the Rev. H. G. De Bunsen, received and guided the party through the church, in which there is an ancient window supposed to represent "Our Lord and His Mother," in the *fleur de lys* costume of A.D. 1280-1300. The party proceeded to "Whiteladies," now a ruin, but once a flourishing convent of Cistercian nuns. It contains some interesting monuments. Boscobel House next occupied the attention of the party. Here it was that Charles II. found shelter after the battle of Worcester in 1651. Much interest was, as usual, centred in the "Royal Oak" tree, in which the King is said to have hid himself while Cromwell's troopers were in search of him. Whether the present safely-guarded tree is the one which afforded a hiding-place to the royal fugitive is matter of controversy. Mr. De Bunsen quoted the Rev. G. Plaxton, Vicar of Donington, 1690-1703, who in his day spoke of "the poor remains of the Royal Oak" being fenced in; Blount, Evelyn, and other authorities, who all spoke of the way in which the original oak had been robbed by relic-hunters, &c. On the other hand, Mr. De Bunsen read a letter from the Earl of Bradford, in which his lordship discarded the usual stories of the owl flying out of the tree, and of a pillow being placed in its branches on which the King reclined; as also he did the equally—as his lordship thought—untrustworthy accounts of the destruction of the tree. In his lordship's family it had been handed down from father to son that the tree was the same as that up which the King, suddenly disturbed when out with the Penderels, hastily climbed; which was described as a growing oak. Nine years after, when the Restoration came, the tree was well known, and when the coppice was thinned it was preserved. From father to son amongst the tenantry it had been known, and his lordship, who had known the tree for fifty years, was strongly of opinion that the tree itself bore evidence of being of the necessary age, and not a sapling from the original tree. The lower branches had, doubtless, been cut away, but not to the extent described. An article appeared in the *Gardeners' Chronicle*, September, 1866, in which the writer holds that the opinion that the tree is a "seedling" is absurd. He goes in for the great age of the existing tree as enthusiastically as Lord Bradford does. He measured the tree to be 11ft. in circumference, but does not say at what height from the ground; and as "18ft. to the crown, and, perhaps, 20ft. more to the top." The Rev. J. Brooke, in 1857, measured it, at 4ft. from the ground, to be 11ft. 4in. in girth; and, with the assistance of an experienced timber merchant, who carefully compared it with other trees, came to the conclusion that it was not then more than 150 years old. Amongst other authorities who had written about the tree, Mr. De Bunsen quoted Dr. Charlett, of Oxford, who saw it in 1702, and who described it as "the trunk of the Royal Oak now enclosed within a round wall;" on which Mr. Dale (who was appointed curate of Donington in 1811,) writing in 1845, remarked "*truncus*, a stump, stock,

or body of a tree." Dr. Stukeley (1713) was also quoted as describing the tree enclosed within a wall, and "almost cut away by travellers," and as having by its side a "thriving young plant from one of its acorns." The Rev. W. A. Leighton said he remembered when a boy his aunt, who lived at Brewood, showing him a bit of touchwood, which had formed part of the original tree, and he had no doubt whatever the tree they were looking at was the sapling mentioned by Dr. Stukeley. Mr. De Bunsen said he had heard of old people who remembered two trees enclosed, and it had been suggested that the wrong one had been shown to relic-hunters so as to preserve the original tree. The party drove back to Shifnal through Weston Park, by permission of Lord Bradford, instead of along the ordinary road.

TAMWORTH NATURAL HISTORY, GEOLOGICAL, AND ANTIQUARIAN SOCIETY.—July 8th.—Monthly Meeting.—Mr. E. D. Hamel exhibited the Microphone, and described the several novel inventions recently brought before the public by Prof. Bell, Eddison, and others. A number of experiments were made with the Microphones, and a most successful evening brought to a close by the usual vote of thanks. On the 19th July an excursion was made to Rugby and Bilton, in which a goodly number of members accompanied the President. The party visited the Schools, (by kind permission of Dr. Jex-Blake,) and afterwards inspected the valuable Archæological collection belonging to M. H. Bloxham, Esq. Conveyances then took the members to Bilton, and both the Church and Hall there afforded much interest. The party reached home again at nine o'clock P.M., after spending a very enjoyable afternoon. August 12th.—General Meeting.—A friendly competition had been entered into between two lady members of the Society as to which could produce the greatest variety of wild flowers growing on the banks of the Rivers Tame and Anker. Eighty-one specimens, carefully labelled, were shown as collected on the Anker, and thirty-three from the Tame. The President afterwards read a paper entitled "Primitive Man," in which he dwelt on the evidence afforded in the Stone and Bronze ages, as showing the existence of man at that time.

WOOLHOPE NATURALISTS' FIELD CLUB.—July 18th was what is courteously designated "The Ladies' Day," and, as is customary, a goodly attendance of ladies recognised the courtesy. The Forest of Dean was the scene fixed for the excursion. Much of the once forest is now bare of trees, but that portion which the Society visited on this occasion is still occupied by worthy arboreal representatives of an earlier state. The Botanists were on this occasion fully to the front, and many interesting finds were secured for their vasculums. Among the most noticeable we may mention *Anagallis tenella*, *Scutellaria minor*, *Pedicularis sylvatica*, *Hydrocotyle vulgaris*, *Hypericum elodes*, *H. humifusum*, and *H. pulchrum*, but the great find was *Campanula hederacea*. A large beech tree, which at five feet from the ground gave a girth of 16ft., attracted deserved attention. Others gave 12ft. 4in. and 14ft. 2in. One, just fallen, gave a girth of 14ft. 6in.; and as the saw had cut its way smoothly through, its age was ascertained, with tolerable accuracy, by counting the annular rings, (123 in number.) which were a little shaky in the centre and at the margin—for which, making due allowances, twenty were added to the plainly visible ones—to be no less than 143 years. The largest beech in the forest measured, at five feet from the ground, 17ft. 4in. in circumference, and its height was estimated at from 90ft. to 100ft. The "High Beeches". are still loftier, and two of them are very grand; but the most imposing only gave a circumference of 16ft. The holly trees about the "Speech House" (an inn so called) are noticeable, some of them being very aged. A few funguses were obtained. Dinner was served in the Verderer's Room at the "Speech House," after which the veteran, Mr. E. Lees, F.L.S., gave utterance to valuable though modestly called "Cursory Notes on the Forest of Dean and some of the Objects Within it," the appreciation of which was, on the motion of Dr. Bull, evidenced by a unanimous vote of thanks for present and past favours to the Club. The company having adjourned to the beautiful terrace on the western front of the inn, Capt. Mayne Reid gave a most pleasing account of the "Chinampas or Floating Gardens of Mexico," which was acknowledged by a cordial vote of thanks. This Field Day was a pleasant and memorable one.

ERASMUS DARWIN.

In the published address of the President of the British Association, at the meeting for 1874, we read that the late Sir Benjamin Brodie had often called his (Professor Tyndall's) attention to the fact that at the end of the last century the philosopher and poet, Erasmus Darwin, who may be especially claimed by the Midlands as their own, was the forerunner of those biologists of the present epoch who have wrought so great a change in vital dynamics. How far this is true may be worth enquiring into, as well as profitable, and we shall probably come to the same conclusion as Sir Benjamin, but at the same time be far from believing that the doctrine of Natural Selection, or the Survival of the Fittest, and the Origin of Species by such simple means, is not the offspring of the thought of our own days. The older philosopher was, indeed, the precursor of the illustrious biologists of our present times, as he was the progenitor of the greatest of them; but it will be seen that in some cases the old and modern theories are just the antitheses of each other. Still it remains a subject of interest to observe philosophers of the last and present centuries, with such relationship, pursuing the investigation of the same identical subjects, whether we attribute the circumstance to the hereditary transmission of the same tastes, a subject well dwelt upon in the writings of both, or simply to the force of precept and example.

Till the year 1781 Erasmus Darwin, M.D., F.R.S., (though he had been previously a short time stationed at Nottingham,) was in practice at Lichfield, but he afterwards resided in Derby. To judge from the "Zoonomia," and from what his literary friend, Miss Seward, tells us, his practice must have been pretty extensive. Indeed, he was an example showing that the life of even a rural disciple of Esculapius, from the natural tendency of his art and of scientific pursuits to mutual diffusion, need not, nay, should not be alienated from the latter; and such an alluring tendency of science towards medicine is happy, for the *liaison* is not always profitable in the vulgar sense. Dr. Johnson, the lexicographer, was in the "sere and yellow leaf" when Dr. Darwin left Lichfield. They had met, but what was the sentence of the Colossus upon the "Botanic Garden," published about three years before Johnson's death, we are not in a position to say. There was no deficiency of other society in and around the little city, such as Darwin estimated, and such as could estimate him—Watt, Boulton, Edgeworth, Day, Wedgwood, Brindley, Dr. Small, (of Birmingham,) and others. No doubt it was at Lichfield, where, taking advantage of some natural capabilities presented by a parcel of land which he had purchased, he had formed a little botanical paradise, that he composed his poems. He was instrumental, too, with Sir B. Boothbey and Mr. Jackson in publishing there part of the works of Linnæus.*

It has been observed that Darwin was entitled to be called "the poet of art and science," but "whose taste for philosophy, perhaps, in some measure, spoiled the poet, whilst his powers of imagination were

* A Miss Jackson, of the same city, published a botanical volume, with numerous drawings of plants, which are far from contemptible. 1840: Longmans and Co.

almost incompatible with the cool investigations of science." For the last, however, he himself apologises, by observing that theorising, when our knowledge is imperfect, is not without use; neither is the theoretic distribution of natural objects, as it developes some of their analogies. His poetry few read now, though it is often distinguished by great taste and elegance of description; in fact, it is the very *embarras de richesses* which is its fault. Though scientific thoughts or pleasing natural objects, sparsely introduced, become giants in poetry in the hands of a Tennyson or a Browning, yet too prodigally used they are worse than ineffective.

Darwin's poems are annotated by copious remarks which display learning, research, and many of them original views to which we have already alluded. His prophecies of future scientific triumphs have often been noticed as marvellous, and they certainly are remarkable, as, for instance, of steamships and railways; but then he ventured upon other predictions—as of subaqueous and controllable aerial locomotion, and many other things which at present are not likely to come to pass. His medical and physiological work, "Zoonomia," 1793-6, contains much that was new at the date of its publication, much that has been developed in our age—for instance, in medicine the recommendation of ovariotomy, and more explicitly of lithotrity; but, at the same time, it displays much of the fanciful and some little of the absurd, though on the whole entitled to a more frequent study. His later poem, entitled "The Temple of Nature, or Origin of Society," unnoticed in some of the biographies, was, we think, published only a few months before his death, in 1802, and has, like the "Botanic Garden," copious philosophical notes.

Taking his works generally, the "Botanic Garden," the "Temple of Nature," "Phytologia," and the "Zoonomia," for we do not think it necessary to specify the particular work, volume, or page, we shall find that, though Erasmus Darwin considers the earth to be still in its juvenile stage (!) he insists upon a vast antiquity, millions of years for it, and observes in accordance with our present geological ideas, that those parts of it which contain the highest mountains are often the newest raised, because they have not existed long enough to be worn down by external agents; he also teaches that there has been a constant development and differentiation going on in the world, even in the sidereal system; as of stars out of nebulæ, quoting the authority of Sir W. Herschel on this subject. He studied the formation of coral-rocks, and of limestone and chalk, by organic agencies. He observes that inland seas, such as the Mediterranean, would soon become freshwater lakes by a slight change of level, as the rivers flowing through them would wash out the salt. He is a friend to the doctrine of heterogenesis, and argues for it at length in the notes to the "Temple of Nature," as well as elsewhere—

Hence without parent by spontaneous birth,
Rise the first specks of animated earth.

He further argues for a formation by apposition, and against the *emboitement* of germs, and supposes all organic beings to have originated in simple plasm, and, when continued through generation, by filaments and molecules or organic particles, derived from every region of the parent (pangenesis.)

He believes it to be shown by the existence of rudimentary or useless parts, such as the nipples of male animals, or the useless toes of swine, that animals have undergone changes—that monsters prove the same thing, but that in some cases monstrosities may be progressive rather than retrogressive, and aim at something to come. Species are not permanent, but may be transmuted—the tendency being an increasing perfection. Animals are first aquatic, then amphibious, and finally aerial; and this is more or less seen in embryology. With respect to the Origin of Species in plants, he quotes Linnæus's opinion that at first there were only as many species as there are true natural orders. He discusses the theory of man's quadrumanous descent.

He gives due influence to a Struggle for Existence as regards the extinction and modification or improvement of animals. With respect to Sexual Selection, he observes "the final cause of this contention amongst the males seems to be that the strongest and most active animal should propagate the species, which should hence become improved." He lays stress on the effect of the natural or artificial cultivation of animals, hence the changes brought about in the horse, dog, sheep, rabbit, and pigeon. He also attributes an influence towards the gradual production of species to the *nisus* to obtain food and ensure security. This last is rather Lamarckian than Darwinian, and it may perhaps be seen that even in respect to the effects of cultivation and sexual selection we have not lucidly expressed the salient point of the modern hypothesis—the certain but gradual effect in the production of species of slight, favourable variation, when developed by Natural Selection, rendered sufficiently efficient by length of time and unlimited numbers of the individuals. The elder philosopher does not tell us that the changes are so inevitable and undirected. He saw in the colouration of birds and their eggs, in the habits of insects, and in the modes of vegetable fertilisation, &c., as well as in physical nature in general, signs of design or extraneous intelligence. Nature, he says, is subject "to immutable laws impressed on matter by the Great Cause of Causes, Parent of Parents, *Ens Entium*." He is more generally correct in attributing some modification of species to climate and season, than to hybridity, which appears to have, on the whole, the reverse effect.

He seems to have taken an interest in the modes of fertilisation of flowers, but was thoroughly ignorant of the participation of insects in that act. The corolla for him was a thing of beauty, and also for the respiration of the sexual organs; the nectar nourished the seeds, and was curiously guarded from the injurious depredation of insects, a superabundance of it only being, in a few instances, as in *Cacalia suaveolens*, acceded to them. He noticed the curious mechanism of the flowers of the broom, but did not discover that this mechanism is generally brought into play by the visits of bees. He gives curious examples of contrivances to effect ordinary fertilisation, mentions the ripening of different sets of anthers at different times, and the different length of sets of stamens in the same species, in *Lythrum* and *Lychnis* for instance; as well as the great appetency of the stigma in some flowers, as *Collinsonia*, for foreign pollen, which he calls *vegetable*

adultery; he saw the injurious effect of breeding by buds alone, and instances disease of the potato as such a result; yet on most of these points he has been left far behind by the observations of his gifted and laborious descendant. He explains the similitude of the flowers of *Ophrys apifera* to the bee, as designed to keep off the insect, the latter supposing that the flower is already appropriated. He was the first to point out the many close analogies of the animal and vegetable kingdoms. He studied climbing-plants, bulbs, and buds, and the effects of grafts on the stock; and he alludes to the admixture of parts of two kinds of fruit in one. He notices the irritability of the leaves and their glandular hairs in the *Drosera*, though not from his own observation, and attributes such actions very strangely to vegetable sensation, ideas, and volition.

He considers instinct to be but an imperfect reason—a gradation to mind; that the race of bees is older than man, because the intelligence of the hive bee is unchangeable and arrived at perfection; that the singing of birds is more like artificial language than a natural expression of passion, as the young bird only learns its song from its parent, or from its own kind. Man has attained his pre-eminence principally by reason of his *touch* and developed powers of *volition*, as dwelt upon in our times by Herbert Spencer and Dr. Carpenter. In "Zoonomia" we have an interesting dissertation on Instinct, of seventy-nine pages, rich in fact. (Ed. 3rd, 8vo., 1801, vol. 1, sec. 16.)

He, more or less probably, endeavours to account for the origin of some of our facial or bodily expressions. He supposes that infants acquire the smile from the pleasure of relaxing the facial muscles after the action of suckling, and associates other pleasant feelings, as the sense of beauty, with the remembrance of the fount of infantile enjoyment. His remarks on hereditary acquirements are numerous and worthy of regard. He considers the acquired or inherited love of drink to be the frequent cause of the extinction of families, and of more than half of our chronical diseases; and even in his time, when the poorer classes could less afford to spend money in the pernicious stuff, as the curse of Christendom: like Prometheus, we take fire in our bosom, and sometimes suffer his punishment, even literally as respects the seat of injury. Darwin combated the gout in his own person at the age of forty by totally renouncing fermented drinks, and continued quite free from it till his death, though he was a gourmand in fruit and non-spirituous drinks of several sorts. From the hereditary tendency to disease arises his observation that "it is hazardous to marry an heiress."

We think that upon the whole we have now traced in the philosopher of the eighteenth many of the germs of thought which have been developed in the present century. But with respect to these more modern doctrines we say little in this article. Few have been more interested in Mr. Darwin's writings than ourselves, but it is not in us to say how far his theory is adequate to the requirements, or whether some *primum mobile*, which the vitalists would supply, is wanting—some doctrine of life as antecedent to, yet wonderfully influenced by, the simple operation of Natural Selection.

All men have not the same cast of mind. What may appear essential to one may seem impertinent to the question to another. Erasmus Darwin, though in his day branded with the name of atheist, and consigned to the infernal shades in the pages of the "Methodists' Magazine," &c., was eminently the reverse, and must be ranked with the teleologists; he certainly was not without the mistakes which are sometimes attributed to the school. Had he lived now he might have appeared in another phase; but whether so or not, we believe that he would have been a bright luminary in biology; that he would have been a popular poet may not be so certain.

KEMPLEY CHURCH, GLOUCESTERSHIRE.*

BY J. HENRY MIDDLETON, ESQ.

The Church at Kempley, in Gloucestershire, consists of a Norman nave and chancel, built probably at the end of the eleventh century: their sizes are roughly—nave, 34 feet by 19 feet; chancel, 18 feet by 14 feet, internal measurement. All the walls of this early part remain, with the west and south doors, the narrow chancel arch, and four of the original windows. In the fifteenth and sixteenth centuries a western tower was added, a wooden porch built on to the south door, and two perpendicular two-light windows were inserted in the nave, probably in the place of older Norman ones.

The dedication of this church is not quite certain, but tradition ascribes it to the Blessed Virgin, and this view is supported by the legend on one of the bells, which is *Dilige Virgo Pia quos congrego Virgo Maria.* Another bell has the following legend:—*Jesu campanam tibi semper protege sanam.* Both these bells date from the reign of Edward III.

The chancel, where the best preserved paintings remain, is covered by a plain, circular barrel vault, built in rubble. This vault has nearly been the destruction of the chancel, by spreading and so pushing out the walls, which were without buttresses, as is usual in Norman work. It has, however, been lately shored up and made secure from outside. Such vaults as these are common in military and monastic buildings of the eleventh and twelfth centuries; but, except the White Chapel in the Tower of London, I do not remember another English instance of a church being so roofed.

The chancel arch, as well as the vault, is much injured and distorted by settlement, and a crack along the crown of the latter has seriously injured the paintings.

The whole wall surface of the chancel, in addition to the soffit of the vault, has been richly decorated with painting, and most of it still remains in a remarkably perfect condition, considering its great age. The comparative freshness of the colouring is owing to the whole surface having been thoroughly covered with repeated coats of whitewash, and

* Read before the Woolhope Naturalists' Field Club, on May 28th, 1878, on the occasion of their visit to Kempley Church.

thus preserved from the effects of light, and other sources of injury. This covering of whitewash we removed bit by bit with the greatest caution and deliberation in the winter of 1872, when the existence of these long forgotten paintings first came to light.*

The paintings are executed on a single coat of stucco laid on the rubble wall, which is so rough and uneven inside that it cannot ever have been intended to be left bare; and I think there can be but little doubt that both the stucco and the pictures are contemporary with the building itself, *i.e.*, somewhere near the year 1100 A.D.

With regard to the technical process by which these paintings were executed, I am convinced that they are not true Frescoes: that is, that they were not painted on the wet stucco with purely earthy pigments and a lime medium: one reason being that the colour is little more than superficial, and has not sunk into and become incorporated with the stucco, as is the case with true Fresco. Another is the absence of "Fresco edges" as they are called, that is, the scarcely perceptible line that separates the patch of stucco laid one day from that of the next day; for, as it was necessary that the colours should be applied to perfectly wet and unset stucco, it was of course needful that no more should be applied to the wall than the artist could cover with one day's work, or in some cases even less. This being the case, then, that the paintings were executed on the finished and dry surface of the plaster, there remains no doubt that they are in some form of tempera, probably with a medium of egg and vinegar, or perhaps simply size. This latter process is sometimes wrongly called Fresco, even by the Italians themselves, who distinguish it by calling it "*Fresco secco*," and the true Fresco, "*Fresco buono;*" but it is better to use the word in its true meaning as implying painting on wet or "fresh" plaster.

In the centre of the vault is a figure of Christ in Majesty, more than life size, seated upon a rainbow, and enclosed in a frame or glory; a cruciform nimbus surrounds his head, and resting on the left knee is a book or tablet, with the letters IHC XPC, for *Iēsous Christos.* The feet are towards the east, and below them, just outside the frame, is a large circle much injured by the crack in the vault. This circle represents the earth made Our Lord's footstool. On each side of this globe is the figure of a seraph, nimbed, with six wings, and bearing a scroll. On either side of the figure of Christ the symbols of the Evangelists are represented—the bull and the eagle on the south side, and the lion on the north side, all holding books. The fourth beast is very indistinct, and is too much injured to be made out. Over the head of Christ are painted the sun and moon—the sun being a yellow roundel surrounded with white rays, and the moon a blue crescent with a small circle inside it. At the sides of these great lights are the

* The discovery of the paintings was brought about through the thorough examination of the walling previous to the proposed restoration of the church, which Earl Beauchamp, the patron of the living, had determined to commence. Mr. Middleton, the Architect engaged for that purpose, on discovering the existence of the paintings, strongly advised that the restoration should not be gone on with, but that the church should be shored up, the whitewash carefully removed, and the surface of the stucco covered with a solution of water glass to preserve the colouring.—EDS. M. N.

seven candlesticks, four on the north and three on the south side; they are blue with white knops and have long tapering candles. Next come two more seraphs, holding books in one hand and small flags or lances with pennons in the other. Beyond these, and close to the chancel arch, we find, on the south side, St. Peter, nimbed, with a key in his right hand and a book in his left. On the north side a figure of the Blessed Virgin, carrying a book; she seems to have no nimbus, but her head is covered with a veil or hood, surmounted by a sort of mural crown.

All these figures are painted on a red field covering the top of the vault. This red field or broad band is bounded by a white stripe on each side, and is stopped at the east and west ends by bands of an interlaced pattern, which are carried all round the vault and walls against the end walls. The side walls of the chancel are each divided into two unequal parts by windows near the east end.

The northern window is very perfect. The inner and outer arches have bands of colour, and the splay of the jambs and arch is covered with a chess-board pattern in squares of red, blue, and white.

The southern window is much injured, but there remains above it, as above the other, a painted canopy of walls and towers. To the west of the windows the wall space is covered on each side by six large arch-headed niches, in which are seated figures of the twelve Apostles. They are all nimbed, and hold books. St. Peter, who occupies the easternmost niche on the north side, is distinguished by a large key, which he holds under his left arm. The others have no distinguishing symbol. They are not arranged in pairs, as is so often the case, but are all looking up towards the central figure of Christ. Below the feet of the Apostles there is an ornamental band or frieze, looking something like a rude inscription, but all painting below it is lost, if it ever existed.

Eastward of the two side windows are a pair of niches, rather wider than those occupied by the Apostles. In each is a figure without nimbus, and holding a staff in each hand, one resting on the shoulder and the other used as a support, suggesting the idea that these figures represent pilgrims. Both wear long tunics, with mantles fastened on the shoulder; and the southern one has a hat of the usual pilgrim form.

The east end has one window with round arched head, concentric with the vault. Below it is a band of interlaced pattern, like that at the ends of the vault. Over this window are three roundels, each containing a half-length figure of a nimbed angel with a scroll, and on each side there has been a large arched niche. The northern one has been completely destroyed by a mural monument which was fixed there, but in the other niche is a very perfect figure of a bishop. He is habited in mass vestments, the right hand is raised in benediction and the left holds a pastoral staff. The chasuble is dark blue or purple, lined with yellow; it is short in front and long behind, as we find in other examples of the same date. There is a broad white orphrey down the front, with a diaper pattern embroidered on it. The dalmatic is white, and reaches to the feet, so that the alb and stole are not visible. The maniple is blue, and very narrow, with expanding

ends of white, with a fringe on each, as on the stole of St. Thomas of Canterbury at Sens. It is worn on the wrist, instead of being held in the hand, as was the more ancient custom, thus showing that this painting is not much earlier than the year 1100 A.D., as the change seems to have taken place in the latter half of the eleventh century. In early times the maniple was simply a napkin, and was used for wiping the priest's hands at the celebration of the mass. The mitre is pale red, not white as it generally is, and of the earliest form, exactly resembling those shown in Byzantine MSS. of the eighth to the tenth centuries; it seems to be worn over a sort of veil, which hangs down behind. At the feet of the bishop, on his right side, is a sort of cup or vase, probably intended for a chalice. On the left is a yellow roundel enclosing a blue cross, which may be a dedication cross; or again, this object may represent a paten.

The coloured decoration is carried over the chancel arch, which is in two plain square orders. The outer order is ornamented with a pattern of interlacing zig-zags, the inner one has ten yellow roundels bordered with red.

Considerable damage has been done to the side walls by two priest's doors, which have been broken through the wall, and by the insertion of a rude arch-headed recess, which was either an aumbry or an Easter sepulchre.

The only painting in the nave which appears to be contemporaneous with those in the chancel is the large one over the chancel arch, representing Christ in Majesty, and the Last Judgment. It is much damaged, and the upper part of it is still concealed by the modern ceiling. The figure of Christ, however, and of Archangels blowing trumpets, are still to be distinguished.

The other paintings are probably not earlier than the fifteenth and sixteenth centuries. On the jamb of the small Norman window, in the north wall, there are figures of St. Michael and a female saint. Between it and the next window there is a curious sort of wheel, enclosing ten circles, the meaning of which is not easy to make out.

On one of the jambs of the southern perpendicular window there is the figure of an Archbishop, and the wall west of it has a number of coarse paintings, which are of a still later date. Paintings like these later ones are far from rare in English churches; but I believe we might search in vain for another instance of paintings like those in the chancel and over the chancel arch, of a date so early as the beginning of the twelfth century, and with their unity of motive and completeness of design. The nearest to these in date are, I believe, the paintings on the chancel walls of Chaldon Church, in Surrey, representing the *Scala humanæ salvationis*, but they are, at least, half a century later than the examples before us.

It will be worth our while to compare a very interesting passage in Durandus' "Ratio Divinorum Officiorum," I., iii., 7—12, which, omitting the twenty-four elders, might almost be a description of these paintings. The great work of Durandus was perhaps better known and more

widely circulated than that of any other author of the early middle ages, and there can be but little doubt that whoever executed these paintings was well acquainted with the following passage:—

"Sometimes Christ is depicted as Moses and Aaron, Nadab and Abihu, saw Him, namely on a hill, and under his feet as it were a work of sapphire, and a serene sky. And since, as St. Luke says, 'There they shall see the Son of Man coming in a cloud, with power and great glory and majesty,' therefore sometimes Angels are painted surrounding Him, who ever serve and wait on Him, and they are depicted with six wings, according to the words of Esaias, 'The seraphim were standing near Him, the one had six wings and the other six wings, and with twain they covered his face, with twain his feet, and with twain they did fly.' Angels are also depicted as in the flower of youth, for they never grow old. Sometimes also the Archangel Michael is painted near them, treading the dragon under his feet, according to the words of St. John in the Apocalypse, 'There was war in Heaven, Michael fought with the dragon,' which war denotes a division between the angels, the establishment of the good, the ruin of the wicked, or in the visible church the persecution of the faithful. Sometimes also there are painted round about him the twenty-four elders, according to the visions of the same John, in white robes, and crowns of gold. Sometimes also are included in the paintings the living creatures according to the vision of Ezechiel, and the same John: 'On the right hand the likeness of a man, and that of a lion, and the likeness of an ox on the left, and that of an eagle over all the four.' These are the four Evangelists, wherefore they are painted with books at their feet. . . . Sometimes also there are painted round about, or rather underneath, the Apostles, having long hair like Nazarites. . . . . Moreover the Divine Majesty is sometimes painted with a closed book in His hands, because no one was found worthy to open that book, except the Lion of the Tribe of Judah. And sometimes He is painted with an open book, so that everyone may read in it, because He is the Light of the World, and the Way, the Truth, and the Life, and the Book of Life."

CONOCHILUS VOLVOX.

The pond near Redditch which for nearly two years yielded a constant and abundant supply of this interesting and beautiful Rotifer, has for the last month or so, on each visit in search of it, been "drawn blank." It is a curious fact that the "sticks" discovered by the Rev. Lord S. G. Osborne, congregated near the centre of many of the colonies from this pond, and called by his Lordship, (*vide* letter to the *English Mechanic* of 1st March, 1878,) "rooks' nests," were for several months in the spring and early summer, when the containing Rotifers were abundant, rarely to be found either floating in the water, in the sediment, or attached to submerged plants. But now that the Conochili have disappeared the sticks are plentiful, both floating freely and entangled in

the brown flocculent matter (which by the way is full of interesting microscopic organisms) with which the water plants are at the present time coated.

There cannot be the least doubt that these "sticks" are Diatoms, though Mr. Hy. Davis, (by whom an interesting article on *C. volvox* was written and published in the "Monthly Microscopical Journal" for July, 1876,) once entertained, I understand, the opinion that they are Desmids, possibly belonging to the genus *Docidium*. This can scarcely be so, as the bodies divide longitudinally, as do Diatoms, and not transversely, after the manner of Docidium and other allied Desmids. They do not (at any rate the form commonly found) belong to the genus *Navicula*, as Lord Osborne originally supposed, as they lack the characteristic "median longitudinal line and nodules;" and his lordship's observation that only one form is found in each colony, and that the size of all the sticks in each is the same, the size varying with the dimensions of the colony, does not accord with my own. In one instance I found a decided Pinnularia, if not *P. viridula* a form excessively like it—one specimen only amongst a number of the common kind. The Diatoms, either owing to the jelly of the Rotifers not being a favourable medium for displaying the markings, or to the fact that the latter are worn away in some mysterious manner, are most difficult to resolve. Those which are free in the water are by no means easy, and though "high powers" have been brought to bear upon them, it is by no means clear which they are. I believe them to belong to the genus *Synedra*, closely allied to, if not identical with, *S. fasciculata*.

It is just possible that the plane spot at the centre of the valves may have been mistaken for the line of transverse division. At first sight it appears inexplicable that other bodies than acicular-shaped Diatoms are rarely, if ever, found in these erratic jelly-masses; but when we take into consideration that the jelly expands as the funnel-shaped creatures emerge, and becomes compressed when they are retracted, it is obvious the quasi tubes in which the animals live are always "too tight a fit" to allow freedom of entry for comers of every class, and it is simply owing to "Natural Selection," (if it is lawful to adopt the expression,) and the needle-pointed shape and hard and unyielding substance of the intruders, that they are able to gain a footing at the threshold. The sudden retreat of the irritated hostess draws, perhaps, one of them in a little way, the closely-pressing jelly retains it while its hostess cautiously passes outwards. Another sudden jerk draws the unwelcome visitor farther in, then another jerk and another, till the unbidden and perhaps unwilling guest reaches the middle of the globe and finds himself merely one "stick" in a "rook's nest."

The "Productive Pond," as Mr. Bolton styled it, now that its stock of *C. volvox* is exhausted, has a rich store of the exquisite Polyzoan, *Plumatella repens*, growing unattached, twining in and out among the rootlets of *Lemna minor*. This condition is more favourable for observation than when the polypidom adheres to a large plant such as *Potamogeton natans*, upon which I usually find it hereabouts, as it is readily seen with transmitted light and without obstruction.—S. S. R.

MOSS HABITATS.

BY JAMES E. BAGNALL.

The habitats or natural homes of mosses are very varied. In fact, mosses may be found everywhere in country districts, so that banks, trees, woods, fields, heath lands, walls, marshes, bogs, and other watery places all have their several mossy inhabitants. Though in many instances mosses show some degree of preference for particular habitats, no positive line of demarcation can be drawn with regard to the habitats of some species. *Ceratodon*, for example, seems to be at home in every locality, whilst others, such as the *Sphagnums* and many of the *Orthotrichums*, &c., are truly selective with regard to their haunts. Hence, I can only indicate the most likely mosses to be found in particular habitats. In many instances the same plants may be found flourishing in equal abundance in a variety of habitats. I have already mentioned *Ceratodon purpureus*, as a moss to be found everywhere. It is abundant on heathy waysides and on old walls, thatched roofs, and even on trees it is no less plentiful.

Banks, whether sandy, marly, or calcareous, are the favourite haunts of many mosses, and if we examine a damp sandy bank between February and April we shall be almost sure to find the dark green silky masses of *Dicranella heteromalla*, easily known by its terminal fruitstalk, which is pale in colour and is abruptly bent back just below the capsule. The leaves will be found to be very narrow and all curved in one direction, and the capsule surmounted by a lid having a longish beak,* [Plate IV., fig. 13 *a*,] the peristome or fringe [Fig. 12 *b*] consists of sixteen teeth, each of which is split half way down.

In like places we shall also find *Weissia controversa*, which has straighter leaves, with the margins rolled over towards the upper surface, erect oval capsules, lid with a long straight beak, and a fringe of sixteen rudimentary teeth; when dry the leaves will be found to be much twisted. Smaller tufts of the apple moss, *Bartramia pomiformis*, may also be found, and may be known even when barren by its glaucous green foliage. The capsules of this moss are apple shaped, and surmounted by a slightly convex lid. The fruit ripens in early summer.

Hypnum prælongum will be frequently seen fruiting about November, but very often barren. In the barren state it may be known by its long trailing feathery stems, which, however, vary very much in habit. When in fruit it will be known by its long roughened fruit stalks, (which are lateral as in all Hypnums,) [Fig. 5 *a*,] curved capsules, and lid with a long curved beak, [Fig. 13 *a*,] the fringe is in two rows, an outer one formed of sixteen teeth, and an inner paler membranous one, divided into sixteen tooth-like processes. *Hypnum rutabulum*, another of the feather mosses, is more robust, has heart-shaped leaves, roughened fruit-stalk, and a shorter conical lid. *Hypnum velutinum* is much smaller, and has narrower lance-shaped leaves, and is more velvety looking; whilst *Hypnum confertum*, which is constantly associated with the above,

*All the references in this article are to Plate IV., facing page 193.

has a *smooth* fruit-stalk, and lid with a longish curved beak. Many other mosses will also usually be found in like habitats.

Marly and clayey banks will yield such mosses as *Fissidens bryoides*, a very beautiful little moss, known by its flattened foliage, with leaves on opposite sides of the stem, looking very fern-like, fruit-stalk arising from the top of the stem and surmounted by an erect reddish capsule, with a cone-shaped lid, and a fringe of sixteen bifid teeth. The fruit of this moss ripens from October to the end of the year. A larger species, *Fissidens taxifolius*, will frequently occur with this, but the fruit-stalk arises from the base of the stem, the capsule is somewhat curved, and has a longish beak; fruit ripe in November. A species similar to *F. bryoides* is also frequent in Warwickshire, this is readily distinguished from it by the capsule, which is curved to one side. This is *Fissidens incurvus*. This species ripens its fruit about February or March.

Another moss, frequent on banks such as I have described, is *Tortula unguiculata*. It may be known by its somewhat tongue-shaped leaves, terminated by a small mucro or point, and having the margin recurved, or turned towards the lower surface; the fringe of the peristome consists of thirty-two spirally twisted teeth. It fruits from December to April. A close ally, *Tortula fallax*, not unfrequent, has leaves tapering from the base, a more curved capsule, and fringe also twisted. Another frequenter of marly banks is the minute *Dicranella varia*, which occurs in patches of a reddish green colour. It has narrowly lance-shaped nearly erect leaves. The capsule is small and slightly inclined to one side, and the conical lid has a very short beak; the fringe consists of sixteen deeply divided teeth. It fruits about November.

Tortula aloides and *T. ambigua* frequently occur together on marly and clayey banks. They are very closely alike, and can only be separated by careful examination of minute details, but may be known from other species occurring in like habitats by the short stem, dark green somewhat fleshy leaves, with the margins very much incurved. The capsule is cylindrical and erect in *ambigua*, and slightly inclined in *aloides*. The fringe is only slightly twisted.

On calcareous banks, such mosses as *Pottia cavifolia* may be sometimes found; this is a small species, having large concave leaves, often terminated by a whitish hair-like point. If the leaves be examined with a lens, some peculiar membranous processes will be seen attached to the veins of the upper surface. The capsule is egg-shaped, and the mouth has no fringe, or is naked, and the lid has a short inclined beak. *Pottia truncata* frequent on all sorts of banks, has a wide-mouthed capsule, and narrower leaves than the last-named variety, with no membranous processes on the upper surface. *Pottia lanceolata* is larger, and has a fringe of sixteen slightly perforated teeth. The leaves are spreading, somewhat oval-oblong in shape, and are terminated by a small green point. *P. cavifolia* ripens its fruit in February, *P. truncata* about November, and *P. lanceolata* about May on sandy banks. Many other species may be found, *Pogonatum aloides* and *P. nanum*, and (in elevated or sub-alpine districts) *P. urnigerum*, *Dicranella crispa*, *Mnium stellare*, *Bryum annotinum*, *Hypnum sylvaticum*, *Phascum subulatum*, &c., while on clayey or calcareous banks, such mosses as *Hypnum molluscum*, *H. Swartzii*, *H. lutescens*, *Weissia mucronata*, *Phascum patens*, &c., will often be met with.

[TO BE CONTINUED.]

RAIN-WASH.

Not long ago I was walking over Middleton Moor in Derbyshire, an elevated exposed tract of land lying a mile or two north-east of Dovedale. The most elevated points of the Moor—Arbor Low, Lean Low, &c.—rise from 1,200 to 1,300 feet above the sea, and lie near its margins, whilst the centre is depressed. After walking over the limestone rock, barely covered with short grass, which constitutes the greater part of the district, I found in a hollow near a farm house a considerable spread of a light red loamy deposit, which had evidently been largely dug, probably to spread over and improve the neighbouring land. It appeared to be from six to twelve or more feet in thickness, and contained no stones or fragments of foreign rocks. I had little more than a passing glance at this red clay, but it struck me that it was an interesting instance of the chemical action of rain water on the typical rock of this district—the Carboniferous or Mountain Limestone.

The Carboniferous Limestone contains about ninety per cent. of carbonate of lime, and, in addition, some silicate of alumina, silica, oxide of iron, &c. Now, the rain water in falling through the atmosphere dissolves out of the latter a little carbonic acid gas, and this combines with the carbonate of lime, forming a bi-carbonate, which is soluble in water, and which is consequently carried off in solution by the latter, thus causing the "hardness" of the water of limestone regions. The other ingredients of the limestone, however, are left behind. Slowly and gradually do they descend the hill sides. On the very hill-tops the bare rock peeps forth, but the slopes are covered with a few inches of *debris*, over and through which the rain water courses, gradually abstracting the soluble part, the carbonate of lime, and mechanically "moving on" the other ingredients, until they arrive at the lowest point. I noted that all the slopes of a given inclination had a terraced or step-like appearance, the lines running regularly, as if ruled at intervals of a few feet. If it be a valley through which a river runs, the insoluble substances on reaching the bottom are then carried off by the stream, whose waters they make muddy and turbid; but on the limestone moors most of the water percolates through the rock, or disappears down swallow-holes, leaving the residue in the surface hollows. Here it accumulates. Most of it is clay, but there is some sand, and the whole is tinged red by the oxide of iron, which, by exposure to the air and water has been raised, if it were not previously in that condition, to the state of the hydrated peroxide. If we could measure the cubical contents of such a deposit, and also by analysis determine accurately the composition of the rock from which it was derived, we might obtain some interesting results as to the amount of denudation of the district in recent times. We might, perhaps, also obtain some idea of the *rate* of denudation, and the *time* which it had taken to form such deposits. In connection with this, the average rainfall might be made to yield results in aid. In the south of England the clay-with-flints, which covers part of the chalk downs has

had a similar origin* to our Derbyshire rain-wash; the red cave-earth of limestone caverns (Kent's Cave for example) is a similar residue. All the soil of our fields, of course, is in large measure due to the disintegrating and chemical action of rain, but I should prefer to retain the term rain-wash, geologically, for any residuum which is wholly due to its action. I should be glad to hear from any correspondents whether they have observed any instances of deposits similar to that noted above, and under what conditions. I believe there are some thick clay beds at the foot of the Weaver Hills, which have been mistaken for boulder clay, but are really nothing but rain-wash, but these I have not yet examined; will anyone describe them for us?

W. J. H.

* Might not the well-known bed of red clay in Tideswell Dale have had a similar origin.

THE PROPAGATION OF *MELICERTA RINGENS* IN AN AQUARIUM.

No one I feel sure can look at *Melicerta ringens* under the microscope without being moved by feelings of the greatest admiration, and at the same time of regret that such beautiful creatures are to be found only in few places. I confess such were my own feelings after having examined some fine specimens kindly sent to me by Mr. Thomas Bolton, of Birmingham, in February last; and I thought if *Melicerta ringens* could be successfully maintained in an aquarium that it would afford an excellent opportunity for the study of the life history of those beautiful creatures. I therefore determined to make the attempt, and am pleased to say my success has been greater than I anticipated. I did not succeed with my first trial, but in the following month Mr. Bolton sent me some remarkably fine specimens. With these I set to work again, and in proof of my success, there is now in a beaker before me two pieces of Myriophyllum, one four inches long, to which are attached 200 specimens, and on another piece, three inches long, there are 150 specimens of *Melicerta ringens*. Indeed, I am sure there are altogether over 1,000 specimens in my aquarium.

Perhaps a description of my arrangements will be acceptable to many who may desire to have this interesting object always at hand. I feel certain these arrangements will prove as successful in the hands of others as they have in mine, and a knowledge of them will, perhaps, induce many to enter into the study of *Melicerta ringens*, as suggested by Mr. F. A. Bedwell in his admirable notes on this subject in the last number of the "Midland Naturalist." I now proceed to describe the plan I have followed, and to point out the conditions which my experience indicates are especially favourable to the propagation of this interesting Rotifer.

The room in which my aquaria are kept is lighted by one window which looks due east; against the south side of the room there is a sideboard, the nearest end of which is three feet from the window. On the sideboard are two aquaria, one holding 1½ gallons and the other four

gallons. The smallest is placed four feet from the window, and the largest, which has been most successful, is placed seven feet from the window. The temperature has ranged from 41° to 68° F.

The bottom of the large tank is covered with a shallow layer of the finest river sand well washed. A little rockery consisting of quartz, limestone, and fluorspar crystals, is arranged at the end. The plants consist of one *Vallisneria spiralis*, three water violets, (*Hottonia palustris*,) and three water milfoils (*Myriophyllum spicatum.*) The last named plants are arranged as much as possible along and under the surface of the water.

The Melicerta is particularly fond of Myriophyllum and duck weed (*Lemna minor.*) There are also in the tank two smooth newts, (*Lissotriton punctatus*,) and of Mollusca there are six *Planorbis corneus*, three *Sphærium corneum*, (to be safe put in no Limnea,) and plenty of Daphnia and Cyclops. The water is very clear and sweet.

On the 4th September Mr. Bolton sent me a tube containing two specimens of the beautiful grouped Rotifer, *Lacinularia socialis*, which I put at once into my aquarium, and now there are five more groups.

My aquarium is now a source of the greatest pleasure to myself and friends. I will not name all the wonderful forms to be met with, but the following list of some of my treasures will, perhaps, be interesting: *Melicerta ringens*, *Floscularia cornuta*, *Limnias ceratophylli*, *Pterodina patina*, *Rotifer vulgaris*, *Stentor Mülleri*, *Epistylis*, *Vorticella*, *Cothurnia imberbis*, *Actinosphærium Eichhornii*, and *Actinophrys sol.* If these observations should be the means of inducing others to enter heartily into the study of *Melicerta ringens* and other Rotifera my object in writing will be accomplished. WILLIAM SHIPPERBOTTOM, Bolton.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF AUGUST, 1878.

BY W. JEROME HARRISON, F.G.S.

A wet month indeed, the rain mostly falling during thunderstorms, of which those on the 4th, 6th, 16th, 24th, and 30th may be specially noted. The storm of the 6th was accompanied in North Leicestershire by hail, which did much damage. At Dalby Hall some of the "lumps of ice" measured one inch in diameter; at Belvoir Castle they were "the size of filberts." At Matlock Bath 2½ inches of rain fell during this storm in "less than two hours." From Nottingham, Mr. Lowe writes: "The monthly fall here (8·76in.) was the largest for the past thirty-nine years." Mr. Davis, of Tenbury, states that the "rainfall for the month (7·81 in.) was excessive, and has only been exceeded twice in the last forty-eight years; in July, 1834, 9·23 inches of rain were registered, and in November, 1852, 8·22 inches."

Temperature was very uniform and about the average, although there was little sunshine. The crops suffered much from standing in the fields, and were not half secured at the end of the month. The barometer ruled rather low. Fogs prevailed on the 25th and 26th.

STATION.	OBSERVER.	RAINFALL.				TEMPERATURE.			
		Total for M.	Greatest fall in 24 hours.		No. of rainy d.	Greatest ht.		Great'st cold.	
		In.	In.	Date.		Deg	Date.	Deg	Date.
GLOUCESTERSHIRE.									
Cainscross, Stroud	W. B. Baker, Esq.	4·40	1·70	23	18	85·0	14	42·0	18
Cheltenham	R. Tyrer, Esq.	5·29	1·18	10	20	74·6	10	48·0	11
Stroud	S. J. Coley, Esq.	4·09	1·23	22	18	74·0	6, 7, 9	50·0	10
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	5·12	·74	5	20	75·0	9	46·0	1
Whitchurch	A. B. George, Esq.	4·98	·86	13	17				
Woolstaston	Rev. E. D. Carr	6·03	1·17	22	24	74·0	10	47·0	17 & 18
Leaton Vicarage, Shrewsbury	Rev. E. V. Pigott	5·15	·95	22	20	74·9	5	43·9	1
More Rectory, Bishop's Castle	Rev. A. Male	4·86	·90	22	21	72·0	6	43·0	1
Bishop's Castle	E. Griffiths, Esq.	6·25	1·28	22	20	74·0	1 & 2	46·0	9 & 26
Cardington	Rev. Wm. Elliot	5·40	1·1	22	20				
Adderley Rectory	Rev. A. Corbet	5·09	·71	30	24				
Stokesay	Rev. J. D. La Touche	5·00	1·06	22	19	72·8	26	43·5	1
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	7·46	1·42	4	22			40·0	17
Stoke Bliss	Rev. G. E. Alexander	8·12	1·94	22	20	75·0	13	48·0	16
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq.	7·81	1·98	8	22	75·0	8 & 14	44·5	8
West Malvern	A. H. Hartland, Esq.	4·68	1·49	22		75·0	9	46·0	16
Pedmore	E. B. Marten, Esq.	6·97	1·09	22	19	77·0	3	48·0	1
Stourbridge	Mr. J. Jeffries	6·72	1·04	22	21	78·0	7, 9, 19	46·0	8
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	6·46	·98	22	22				
Barlaston	W. Scott, Esq.	6·50	·82	24	25	76·0	2	40·8	21
Amblecote	Mr. J. Robins	7·31	·98	22	20				
Dudley	Mr. J. Fisher	7·52	·94	6 & 22	21	80·0	9 & 18	44·0	16
Sedgley	Mr. C. Beale	7·32	1·17	22	22	71·0	2 & 9	47·0	16
Kinver	Rev. W. H. Bolton	6·33	·85	27	23	77·0	9	48·0	16
Walsall	Mr. N. E. Best	7·63	1·28	22	21	78·0	1	48·0	16
Grammar School, Burton	C. U. Tripp, Esq.	4·37	·66	14	22	80·0	7	44·0	30
Patshull Gardens	Mr. T. W. Dell	6·61	·83	23	19	82·0	26	42·0	1
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	5·97	·88	18	22	77·0	6 & 9	44·0	1
Wrottesley	E. Simpson, Esq.	6·48	·86	22	22	74·5	10	46·6	1
Tamworth	W. Arnold, Esq.	6·03	1·09	3	22				
Tean Vicarage, near Cheadle	Rev. G. T. Ryves	7·03	·85	13	25	74·0	5	42·0	1
Heath House, Cheadle	J. G. Philips, Esq.	7·91	1·21	6	25	71·0	2, 5, 6	43·0	17
Alstonfield Vicarage	Rev. W. H. Purchas	5·74	·56	6	21	74·6	26	41·0	2
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	6·19	·95	4	21	76·0	6	51·0	16
Coventry	J. Gulson, Esq.	5·57	·84	4	21	72·0	11 & 12	48·0	1
Bickenhill Vicarage	Rev. W. R. Capel	6·66	·87	6	24	81·0	31	50·0	31
St. Mary's College, Oscott	Rev. S. J. Whitty	6·29	1·03	22	19	74·7	18	46·2	1 & 9
Henley-in-Arden	T. H. G. Newton, Esq.	6·24	1·17	4	19	78·0	9	46·0	31
DERBYSHIRE.									
Buxton	E. J. Sykes, Esq.	6·77	1·15	13	23	69·5	2	42·0	17
Stoney Middleton	Rev. U. Smith	6·92	1·09	13	22	70·0	2 & 26	42·0	21 & 28
Fernslope, Belper	J. G. Jackson, Esq.	7·25	1·54	6	24	73·0	5 & 9	47·0	1
Matlock Bath	R. Chadwick, jun., Esq.	9·27	3·12	6	22	70·0	26	46·0	1
Linacre Reservoir, Ches'field	C. E. Jones, Esq.	6·41	1·13	23	22				
Willesley Gardens, Cromford	J. Tissington, Esq.	8·82	2·47	7	15				
Stuffynwood Hall	Mr. R. Rolfe	7·04	1·09	23	24	74·0	1 & 2	46·0	1 & 21
Spondon	J. T. Barber, Esq.	6·75	·91	13	24	71·0		50·0	
YORKSHIRE.									
Tickhill, Rotherham	B. J. Whitaker, Esq.	4·95	·75	7	19	76·0	28	41·0	22
NOTTINGHAMSHIRE.									
Hodsock Priory, Worksop	H. Mellish, Esq.	4·70	·87	6	21	74·4	26	42·2	1
Grove House, Mansfield	W. Tyrer, Esq.	8·27	1·30	23	24	72·8	9 & 26	43·9	1
Tuxford	J. N. Dufty, Esq.	7·00	1·05	23		84·0	4	46·0	19
Highfield House, Nottingham	E. J. Lowe, Esq., F.R.S.	8·76	2·52	6	22	78·9	9	43·9	1
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	4·53	·65	22	19	77·5	6	45·7	1
Ashby Magna	Rev. E. Willes	4·15	·84	3	21	75·0	3	46·0	1
Market Harborough	S. W. Cox, Esq.	5·66	·90	22	21	77·0	21	45·0	20
Kibworth	T. Macauley, Esq.	5·30	1·04	3	21				
Town Museum, Leicester	W. J. Harrison, Esq.	6·76	1·78	3	21	74·8	5	46·1	1
Belmont Villas, Leicester	H. Billson, Esq.	6·72							
Syston	J. Hames, jun., Esq.	5·85	1·63	3	26	81·0	2	45·0	1
Waltham-le-Wold	E. Ball, Esq.	5·74	·92	24	21	73·0	6	49·0	19
Little Dalby Hall	G. Jones, Esq.	6·75	1·95	3	20	81·0	9 & 26	40·0	1
Coston Rectory, Melton	Rev. A. M. Rendell	5·48	·86	22	20	73·8	5	38·7	1
Belvoir Castle	W. Ingram, Esq.	5·09	·76	14	21	75·0	8 & 9	40·0	1
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	4·16	·64	13 & 22	18				
Castle Ashby	R. G. Scriven, Esq.	4·77	·70	22	18	76·0	6 & 9	45·0	21
Pitsford	C. A. Markham, Esq.	4·31	·89	13	20	89·0	8	42·0	1
Kettering	J. Wallis, Esq.	4·73	1·19	3	19	75·0	7	51·0	21
Althorpe	W. F. Jakeman, Esq.	4·80	·91	3	18	76·0	5	46·0	25
Northampton	H. Terry, Esq.	4·41	·94	24	18	77·0	5, 6, 9		
RUTLAND.									
Burley-on-the-Hill	W. Temple, Esq.	7·33	3·03	4	18	70·0	5	45·0	21
West Deyne, Uppingham	Rev. G. H. Mullins	5·34	1·20	3	20	78·2	26	45·4	21
Northfields, Stamford	W. Hayes, Esq.	6·03	1·72	3	20	76·0	6	49·0	30
Radcliffe Observatory, Oxford	Mr. H. W. Bellamy	5·12	·98	4	19	75·7	10	49·8	16
Spital Cemetery, Carlisle	T. Bell, Esq.	4·00	·60	3	23	79·0	1	44·3	15
Ventnor Hospital	H. Sagar, Esq.	5·72	1·15	10	21	70·0	8	55·0	2
Altarnun Vicarage	Rev. G. Tripp	6·93	1·06	13	22	79·0	7 & 8	43·0	4

At Bishop's Castle the swallows were noted to be gathering for departure on the 19th, but many still remained on September 2nd.

At Alstonfield a great body of swifts *(Hirundo apus)* retired about the 10th. Hybernated specimen of the Painted Lady butterfly was seen on Derbyshire side on the 15th, and of Red Admiral on the 20th. The glow-worm was noted shining in the moist evenings after days of heavy rain. From Shifnal the Rev. J. Brooke writes—"Few butterflies, scarcely even white ones; and only one or two Red Admirals, Peacocks, and Tortoiseshells; not one Clouded Yellow, although we had such a strange influx of this species in August, 1877. Swifts gone by the 10th."

Reviews.

Proceedings of the Birmingham Philosophical Society. First Session, 1876-77. Vol. I, No. 1. Birmingham: Martin Billing.

We have already announced (p. 141) the issue of the first part of the Proceedings of the Birmingham Philosophical Society. We now proceed to give some account of the contents, and in doing so warmly congratulate the Society on the good work its members have already done. We trust this publication may prove to be the commencement of a long series of valuable contributions to local scientific literature. Of eighty-two pages of "Proceedings" seventy-five are covered by three papers.

The first of these is by the Rev. H. W. Watson, of Berkswell, and is on "The Kinetic Theory of Gases." Mr. Watson calls attention to the endeavours which have been made "to form a plausible theory of the constitution of a gas." He states, first of all, the theory in accordance with which the elasticity of a gas is the result of the mutual influence of the ultimate atoms of the gas upon one another. These atoms, it was supposed, mutually repelled one another, and the combined repulsion produced the outward thrust or pressure against the envelope of the gas. Mr. Watson points out how it can be demonstrated mathematically that such supposed mutual repulsion of the particles of a gas fails to account for the pressure which manifests itself. He then enters upon an explanation of the theory associated with the title of his paper. According to this, the varying states of elasticity of gas imprisoned within any flexible and expansible envelope, or in any cylindrical chamber fitted with an air-tight movable piston, are due, not to the mutual repulsion of the gas particles, but to the varying energy with which they all vibrate across their points of mean position. The pressure upon the containing envelope always varies with the temperature of the gas; and as heat is now looked upon as a manifestation of energy of vibration, the adoption of "the kinetic theory of gases" is but consistent with the reception already accorded to the corresponding theory as to the nature of heat. Mr. Watson, however, very candidly shows that the kinetic theory, in one respect, fails to account for experimental results.

Mr. G. Hookham, M.A., of Sutton Coldfield, contributes a thoughtful paper on "The Study of Science as an Instrument of Higher Education." By "higher education" Mr. Hookham means the education which should be begun when the mind has been disciplined at school or college by a course of formal study. Habits of thought once gained, the aim of each mind should be to assimilate to itself truth as to the constitution of the universe. This can only be done effectually by individual devotion to some special science. It should, of course, be remembered that every such science has relations with the whole domain on which enquiries can be prosecuted. Results attained by others in other departments may be known; but mere accumulation of knowledge of results is not "higher education." This can only be secured by the mind coming into contact with the realities of the universe. And what is higher education for the individual mind helps on also the general enrichment of humanity in knowledge. This is, Mr. Hookham thinks, especially exemplified in the beneficial influence which the German Universities, in which the studies are wholly real, are exercising upon the world.

The paper on "The Place of Archæology in Science," by Mr. James Kenward, F.S.A., of Harborne, is a most readable one. In a very broad sense, Mr. Kenward remarks, all sciences which concern themselves with the operations of nature, or with the thoughts, words, and deeds of man, in past times, may be looked upon as parts of a grand Archæology—the Archæology of the universe and of man. But his concern is with Archæology "as limited to human monuments and human relics; as a study and a summary of the remains—written, graven, sculptured, painted, built up, formed and finished in any mode—which appeal to us from palace and pyramid, and temple, and cave, and cairn; from book, and manuscript, and oral tradition." Besides being in itself of interest to all for whom the past of human history is a "divine drama," Archæology is a valuable auxiliary to all other sciences. The progress of none of them can be estimated without an appeal to it. Mr. Kenward's attractively written sketch of the development of Archæology ought to be widely read.

H. N. GRIMLEY.

The Superficial Geology of the Country adjoining the Coasts of South-West Lancashire. By C. E. DE RANCE, F.G.S. London: Longmans and Co. 8vo., 17s.

THIS Geological Survey Memoir describes in detail the surface deposits of the low plains lying between the estuaries of the Mersey and the Ribble, and also in a more general way the same beds as far to the north as Morecambe Bay, southwards to the Dee, and eastwards to Blackburn, Bolton, and Manchester.

It contains 139 pages, including a few simple woodcuts, is bound in a paper cover, and is issued by Her Majesty's Stationery Office at the modest price of seventeen shillings, a fact which must be equally aggravating to the officers of the Geological Survey and to the public.

The author commences by describing the physical geography of the district—a plain but little above the sea, and sloping down to it, with

lines of sand hills or dunes running along the coast. The solid geology of the country is composed of Triassic strata, but these are hardly ever visible, being covered over with beds of glacial drift, often as much as 150 feet in thickness. Of these the lowest deposit seen Mr. De Rance calls the *Till*. It is a dark leaden-coloured clay, occurring at elevations of 200 feet and upwards only. It contains angular blocks of local origin, but no shells, and seems to have been formed by a sheet of land-ice. Upon it rests the *Lower Boulder Clay*, of reddish-brown colour, with many stones and boulders of lake-district rocks. It is finely exposed in the cliffs north of Blackpool. It is often stratified, and the stones, though striated, are partly rounded. Hence it would seem to tell us of a period of submergence when ice drifting from the north and east dropped its stony cargo in a shallow sea. Shells are not uncommon.

The *Middle Drift Sand and Gravel* marks a mild period, when the glacial cold had decreased. It is sometimes as much as 70 feet thick, but is often absent. The molluscan remains show a mingling of northern and southern forms. It is commonly false bedded.

The *Upper Boulder Clay* is sometimes 100 feet thick. It is of a dull red tint, weathering on the surfaces or joints which may be exposed to the air, to a bluish-white. Large boulders are rare, but glaciated stones and shell fragments are common. Mr. De Rance believes that it was deposited under similar conditions to those of the Lower Boulder Clay, viz., from ice-floes in a shallow sea.

Thus the same triple division of the Drift is observable here as obtains on the east coast of England. The two, however, were not contemporaneous; and it is a pity that the same names should have been applied in each case to the different sub-divisions. Mr. S. V. Wood, jun., has shown the great probability that the Lancashire Drift is of later date than that of East Anglia. Is it possible that the east and west played a game of see-saw—the east coast first undergoing depression, while land-ice scoured out Lancashire? The Geologists of the Midland Counties must endeavour to aid in the solution of this problem, by tracking the deposits as far inland as possible.

In the latter part of his work Mr. De Rance treats at length of the Post-glacial deposits, especially peat; of the economic uses of the various deposits; the water supply; the deposition of shingle and sand forming the dunes; the action of tidal currents on the Lancashire coast; and various other interesting points. One valuable feature of the work is that abstracts are given of almost all the papers that have been written by previous authors on the subject. In an appendix (revised by Mr. Etheridge) the occurrence of the various shells which have hitherto been found in the glacial deposits of Lancashire is shown with great fulness. On page 132 we note a very obvious misprint of "clay" for "crag." Altogether, we evidently have in this Memoir the results of some years of really tough work—of work which only a love for science could make pleasant. Mr. De Rance may be congratulated in that he has given us a record of hard facts which will endure and serve as a work of reference for many a year to come.

W. J. H.

Correspondence.

Duration of Life of Cage Birds.—My canary died to-day, aged 15 years and 2 months. The one I had before it lived for 16 years. Are not these ages considerably beyond the average?—J. B., Leicester, Aug. 24th.

Woodcock.—On the 5th of September I saw a Woodcock put up within half a mile of this place, by the side of a large pool of water. When flying off, it appeared to be at a loss to know where to go, and evidently seemed to feel like a fish out of water. I am not aware that this bird is usually seen in England before October; possibly some of your correspondents can give some information on this point.—W. S. Gresley, Overseile, Ashby-de-la-Zouch.

Cuckoo.—In the August number of the "Midland Naturalist" I read that Mr. J. R. Thompson, of Tamworth, has "obtained a Cuckoo's egg in the South of England as early as March 3rd." Will that gentleman kindly inform your readers in what year that occurred, also by whom taken and authenticated? I have never yet heard of a really trustworthy record of the appearance of the Cuckoo in any part of England before the 6th of April; and, personally, although I have noted the arrivals of migrants for nearly twenty years in the South of England, I have no record of the arrival of the Cuckoo before the 12th of April; neither have I known during the whole period of my observations the times of appearance to vary more than five or six days.—Henry Reeks, Manor House, Thruxton, near Andover. [Mr. Thompson replies:—"The Cuckoo's egg referred to in my letter (see ante p. 227) was sent me as a curiosity by the father of one of my pupils named Boult, the son having taken it from a nest in a hedge, Couch Lane, Winkfield, Windsor, 1848, not a particularly open year, but which had some very cold weather even late in April when there were sleet and snow storms. The shrubs which had a few hours before given an appearance of summer were enveloped in snow. I am enabled to fix the date with much exactitude by circumstances which I need not mention. Mr. Boult, who was then about sixty years of age, sent me the egg to prove that the bird in some cases arrives very early among us though seldom heard till mid-April, and the circumstance was a great surprise to himself."—Eds. M. N.]

The Cuckoo's Note.—It is with the greatest pleasure I hail the arrival of the "Midland Naturalist" from month to month, and feel deeply interested in its general subject matter, its meteorological notes, its gleanings, correspondence, &c., and never peruse it without deriving profit; and my idea is that encouragement should be given to those who ask for information through its interesting columns, as this may lead many young Naturalists to pursue a study which a rough style of answer might cause them to forsake. Hence my having replied to the enquiry of "N." in your July number, imagining some might not deign to answer a question apparently so unimportant; but the number of replies has convinced me that a hard and fast line of action is not common to the Cuckoo, (as your correspondents' experience in different parts of the country help to show,) and that its cry somewhat varies under diverse circumstances. I should like, however, to state the opportunity afforded me in times past of observing the bird; not with any view of gainsaying the statements of your correspondents, Mr. E. J. Lowe and the Rev. A. S. Male, kindly furnished in your September number, but with a view to a more accurate knowledge being gained by further observation in various localities. In the summer of 1845 I left London, my birthplace, for a sweetly retired village, four miles west of Windsor, and on the edge of the forest,

where I resided till 1854; and, being of a very retiring disposition and loving secluded nooks, most of my waking hours, when duties were over, were spent in the broad glades of the forest, in its deep recesses, or in wanderings over the neighbouring heaths; always alone, and avoiding the residence of man; consequently, I have had many opportunities of observing the actions of the denizens of the forest, and the peculiarity of some members of the feathered tribe, which those journeying in company might not have had. The Cuckoo is an extremely shy bird, and I have found many country persons who have never seen one, unless it has been when flying; and they may even then have supposed it to be a pigeon. A person must be very quiet, and hidden, or, in a general way, he will not get a near sight of this shy bird. Hence arise many mistakes. It is certainly here some days, at least, before uttering a cry at all, and then it is very infrequent and indistinct; but, as time goes on, the bird is heard very frequently and distinctly, and just before its departure it utters the repeated cry alluded to very frequently. I have never heard the peculiar cry *early* in the season; but it is evident, from Mr. Male's letter, that in some places the cry is so heard. The aged cottagers, in the neighbourhood I speak of, used always to remark, when the repeated sounds were uttered, "The Cuckoo is off, he does not like the haycocks;" and the better class would say, "The Cuckoo is bidding good-bye to Old England." In fine, in that part of the country, the cry was an acknowledged sign of its departure. With respect to the observation of Mr. E. J. Lowe, I must remark his observation will not apply to all parts, as I have watched the bird fly into a tree, utter the single cry two or three times, then the reiterated cry, and lastly fly off, perhaps uttering "cuckoo" while on the wing. So it is clear the habit of the bird is worthy of a closer observation, and that over a more extensive area than has yet been given it.—J. R. Thompson, Tamworth.

Rosa latebrosa (Nob.) in Warwickshire.—About five years since, I found a rose in one of the Solihull lanes which seemed to me to be a variety of *Rosa canina*, but distinct, as I thought, from any of the varieties described in Mr. J. G. Baker's valuable monograph of the genus, and as it was very nearly allied to *Rosa verticillacantha*, (Merat,) I labelled it in my herbarium, *R. verticillacantha* variety. Recently, however, I received from Mr. T. R. Archer Briggs, of Plymouth, one of our best authorities on Roses, a specimen labelled *Rosa latebrosa*, (Nob.,) and I at once saw that my rose from Solihull was identical with Mr. Briggs's plant; but to be more sure, I sent Mr. Briggs a specimen of the Solihull plant out of my herbarium, and received the following reply:—"Some time ago I arrived at the conclusion that a rose collected by yourself was identical with the plant from this neighbourhood (Plymouth) that M. Deseglise labelled *Rosa latebrosa* (Nob.) The flowering specimen you have sent certainly puts the matter beyond all doubt. I am very pleased to see that this rose keeps up its characters in so widely separated parts of England." Plymouth and Solihull are at present, I believe, the only British stations for this rose. Mr. Briggs says it is abundant in his neighbourhood, but at present I have only seen it near Solihull, in Warwickshire, two fine bushes growing near together in that locality. It is closely allied to *Rosa verticillacantha*, (Merat;) in fact, would follow that plant in natural sequence, but differs in having intermediate armature on the flowering shoot, in this respect apparently approaching some of the *spinosissima* group. This plant is, therefore, an addition to our Warwickshire rose flora. No English description has yet been published of this rose.—James E. Bagnall.

Notes on the Flora of Napton.—Understanding that the neighbourhood of Napton-on-the-Hill has not been much worked by botanists

I made an excursion thither on August 17th, with the object of looking up and recording, if worth while, any rare or interesting plants. A single visit, and that so late in the year, can hardly give a fair idea of the flora of a district; however, I submit to your readers some notes on that excursion. Starting from Birdingbury Station, on the Rugby and Leamington line, I noticed, just outside the station, *Lotus tenuis*, *Sison Amomum*, *Silaus pratensis*, *Carduus eriophorus*, *Senecio erucifolius*. In former years I have turned up *Galium tricorne*, *Linaria spuria* and *Elatine* in the first corn-field, adjoining the road to Frankton. Leaving Birdingbury village, on my way to the wharf, I observed *Scabiosa columbaria* and *Carduus acaulis*, both growing abundantly in a meadow on the right of the road, some 300 or 400 yards past a windmill, and a little further on *Brachypodium pinnatum* growing with *B. sylvaticum*, *Silene inflata*, and *Picris hieracioides* in abundance. From Birdingbury Wharf I followed the canal to Napton, observing on my way *Sparganium simplex*, *Alisma lanceolata*, *Lotus tenuis* again in plenty, and close to Napton *Rumex viridis*. By the reservoir I saw *Nasturtium amphibium*, *Helminthia echioides*, *Polygonum amphibium* and *terrestre*, *Stachys palustris*, *Potamogeton lucens*, *Juncus lamprocarpus* and *compressus*, *Carex hirta;* in a cornfield on Napton Hill were *Centaurea Scabiosa*, and a plant which seemed to be some hybrid form, possibly *Stachys ambigua*, a hybrid between *S. palustris* and *sylvatica*, but much more nearly approaching the former than the latter. In fact, it appeared to differ from *S. palustris* only in having less elongated racemes, terminating somewhat abruptly, all the leaves shortly petioled and oblong-lanceolate, and in its habitat, growing as it did in a dry cornfield on a hill of considerable elevation, (from which, by the way, I obtained a magnificent view of the surrounding country,) and not a single specimen only, but in great abundance. The leaves are all shortly petioled, petioles one to three lines long, smaller than in *S. palustris*, rather crenate than serrate, and the whole plant is smaller generally than in *S. palustris*. It has been suggested to me that the spot might be a reclaimed marsh, and that this plant is the remains of the marsh vegetation, and hence its starved appearance. This I do not think at all likely; the appearance of the ground seemed to me to preclude the possibility of its ever having been a marsh or anything approaching one, being, as I have said, on a hill of considerable height, and of a dry soil; and, moreover, the plant was in great abundance growing amongst the wheat. Perhaps some reader of the "Midland Naturalist" can give some explanation. The last observations I made were at Shuckburgh, viz., *Conium maculatum*, *Circæa lutetiana*, and remarkably luxuriant forms of *Brachypodium sylvaticum*, attaining, I should say, over 4ft. in height.—H. W. Trott, Rugby.

The Royal Oak at Boscobel.—In the report of the excursion of the Shropshire Archæological and Natural History Society, in the last number of the "Midland Naturalist," the age of the tree now shown as the Royal Oak is discussed. It is said that in 1857 its girth was 11ft. 4in. at 4ft. from the ground. I have counted the rings and measured the average rate of growth of a good many trees of various kinds, and have adopted as a rough but fairly accurate estimate of the age of oaks, that every foot diameter represents about fifty years of growth. The increase is greatest in middle life. The annual ring of wood is never less that $\frac{1}{16}$ of an inch thick, and not often more than $\frac{1}{4}$ inch. Taking the average as $\frac{1}{8}$ all round the trunk, the diameter would increase $\frac{1}{4}$ inch annually, or a foot in forty-eight years. A tree 11ft. 4in. in girth is 3ft. $9\frac{1}{3}$in. in diameter, which according to this calculation would represent about 180 years of growth. But the tree in which the King took shelter must have been in 1857 about 250 years old. The rapidity of growth is affected by soil and climate, and I do not know the soil of Boscobel. If it is poor and shallow

the annual increase would be less, and the tree might be 200 or even 220 years old, but I think it is scarcely possible to carry back the origin of an oak of the dimensions given so far as 250 years, and, therefore, there seems a strong probability that the present tree is not the original but the descendant spoken of by Dr. Stukeley.—F. T. Mott, Leicester.

Gleanings.

The Annual Fungus Foray of the Woolhope Naturalists' Field Club will be held at Hereford on October 3rd.

The Cryptogamic Society of Scotland will hold its Annual Conference at Edinburgh, on October 9th, 10th, and 11th, under the presidency of Professor Balfour. The programme includes excursions, a dinner, and an exhibition of fungi.

Locusts.—The United States Entomological Commission have issued their report on the ravages of the Rocky Mountain Locust. *Nature* says it is "a very important addition to the scientific and practical literature on this subject."

Plant List for Derbyshire.—The Rev. W. Hunt Painter, of 2, Belgrave Street, Derby, is engaged in editing a "Plant List for Derbyshire." He will be glad of any assistance that botanists, residing in the neighbouring counties, can render him. Specimens of the plants found will be thankfully received, and, if desired, others will be given in exchange.

Microscopical.—Mr. Thos. Bolton, Naturalist, 17, Ann Street, Birmingham, announces that for a subscription of £1 1s. per half-year, paid in advance, he will supply a tube of living specimens every week. The specimens will include all varieties of which he may obtain a sufficient supply, and will be forwarded as nearly as possible in twenty-six consecutive weeks. To some subscribers he has agreed to forward the twenty-six tubes during twelve months, or one per fortnight, and to others (science teachers) more rapidly as they may require them for class work or exhibition. To such subscribers he also will from time to time post any notices or sketches that he may print of the various objects he is distributing.

Thos. Oldham, born (Dublin) 1816, died (Rugby) 1878.—Mr. Oldham received his first lessons in geology at Edinburgh, from Prof. Jamieson. Returning to Ireland he aided Portlock in the survey of Derry and Tyrone, (1843,) and afterwards held several offices in connection with the Geological Society of Dublin and the Government Geological Survey; in 1849 he discovered the fossil named after him by Prof. E. Forbes, *(Oldhamia radiata,)* the then oldest known fossil organic remain. In 1850 he was appointed first director of the Geological Survey of India, and in ten years he succeeded in mapping geologically (with the aid of about twelve assistants) an area in Bengal and Central India of about twice the extent of Great Britain. The publications of the Indian Survey, issued under his direction, are of a magnificent description—quite equal to those which Dr. Hayden sends forth with such liberality from Washington. He was awarded the gold medal of the Royal Society in 1875, and shortly afterwards retired from his post of Superintendent of the Indian survey. His last days were spent at Rugby, where he took much interest in the School Natural History Society. His obituary (from which this short notice is mainly compiled) appears in the "Geological Magazine" for August, as do also two reviews by him (his last work, he wrote them but did not live to correct the proofs) on Barrande's "Cephalopoda of Bohemia" and Hayden's "Geological and Geographical Atlas of Colorado."

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—August 6th.—GENERAL MEETING. The Chairman made some general remarks upon the recent excursion to Arran, and spoke in high terms of the cordial disposition displayed by every individual composing the party, which contributed so much towards the general success. He also stated that the unanimous opinion of the party was that the next excursion should be for fourteen days, and that it be to Falmouth. Mr. J. F. Goode exhibited a photograph of the steam boat "Lizzie," and described the arrangements on board and the mode of dredging. Mr. W. H. Wilkinson exhibited a number of plants collected in Arran, amongst which were *Drosera anglica*, *Pinguicula lusitanica*, *Polypodium Phegopteris*, *P. Dryopteris*, *Lastrea montana*, *L. recurva*, *Asplenium maritimum*, and *Lycopodium alpinum*. Mr. W. R. Hughes made some observations upon some of the more remarkable specimens which were dredged. These included the rare star fish, *Luidia fragilissima*, and *Carinella lineata*, a Turbellarian worm, one of the most handsome and graceful of the whole order, also several Nudibranchiate Mollusca, notably *Doto coronata*, *Doris pilosa*, and *Ancilla cristata*, new to the district. The collection, which was very numerous, included an undescribed worm, and a species of Goby not yet determined. Mr. Hughes said the specimens would be carefully examined and a further report made. The results with the towing net devised by Mr. Allport were very successful, and included *Bipinnaria* and larval forms of Echinoderms and living Foraminifera. Mr. Miles exhibited a beautiful series of mounted specimens of Marine Algæ, from Drummadoon Bay.—MICROSCOPICAL GENERAL MEETING.—August 20th. Mr. Bolton exhibited *Cristatella mucedo*, and the cast shell of a small crab; Mr. M. Browne exhibited the larvæ of the Death's Head Moth, *(Acherontia Atropos,)* taken in George Street, Spring Hill; and (on behalf of Sir Arthur Scott) two specimens of an African Moth, *(Leto venur.)*—September 2nd.—GENERAL MEETING. Mr. Bolton exhibited *Lacinularia socialis*; Mr. J. Levick exhibited *Actinophrys Eichhornii* in conjugation, and *Spirostomum ambiguum*. Mr. T. J. Slatter exhibited *Fredericella sultana* and *Paludicella Ehrenbergi*, from near Redditch. Mr. W. Southall exhibited the following plants, from the Lake district:—*Parnassia palustris*, *Utricularia vulgaris*, *Saxifraga stellaris*, *S. aizoides*, *Lycopodium selaginoides*, *Equisetum sylvaticum*, and *Oxyria reniformis*. —On Monday, September 16th, an excursion took place, when about sixty ladies and gentlemen visited Malvern and Eastnor Park and Castle. The party left Birmingham at 9 30. Carriages were in waiting at Malvern Link to convey the visitors to the British Camp. After luncheon the Rev. W. S. Symonds, of Pendock, near Tewkesbury, delivered a graphic and interesting address on the geological and historical features of the Malvern range. Afterwards a portion of the party walked over the hills to Eastnor. Mr. Symonds' intimate acquaintance with the neighbourhood eminently qualified him for his position of guide, and enabled him to point out the numerous objects of interest both on the hills and in the distance. On Midsummer Hill, Mr. J. T. Burgess, of Worcester, gave a brief description of the British Camp formerly existing on that spot, and also indicated the probable site of the camp occupied by the opposing Roman forces. Having inspected the quarries at Ragged Stone Hill, the party proceeded to Eastnor, where, in the meantime, the Castle and grounds had, by permission of Earl Somers, been visited by another portion of the company. Mr. W. Coleman (the Head Gardener) courteously conducted the members over the grounds, which are most lovely. Having been joined by the contingent who had explored the hills, ample justice was done to an excellent tea provided in a tent adjoining the Somers' Arms Hotel. During tea the Rev. W. S. Symonds gave a short account of the Ragged Stone Hill, and related some interesting legends connected with its history. Votes of thanks were then passed by acclamation to the Rev. W. S. Symonds and Mr. J. T. Burgess, for the admirable way in which they had acted as guides; and to the Right Hon. Earl Somers for his kindness in allowing access to his Castle and grounds. A charming drive to Malvern Link in the fresh autumn air, and then a two hours' ride by rail, brought the party safe back again, everyone being delighted with one of the most enjoyable excursions of the season, the arrangements for which were admirably carried out by the hon. sec., Mr. J. Morley.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY. —The sixth annual meeting was held on September 11th, in the Council Room, at the Institute, Mr. G. H. Twigg (President) in the chair. Large attendance of members. The annual report stated that the number of members is 123, the number from the industrial department being 96, from the general department 12, and life members 15. This showed an increase of 14. Papers had been read during the past session on various scientific subjects, the annual soirée was held on January 2nd, and eight excursions had been made to places of interest. The Librarian reported that 580 scientific books were issued last year, against 393 in the previous year. The committee had decided to join the Midland Union of Natural History Societies, and delegates attended the annual meeting of the Union. The finances of the Society were in a flourishing state. The report having been adopted, a vote of thanks was passed to the Council for the use of the room. Mr. Robert Birbeck was elected President, Mr. C. J. Watson Vice-President, Mr. Robinson Treasurer, and Mr. Crick Librarian. The retiring President (Mr. Twigg) then delivered an address, in the early part of which he called attention to the lack of convenience which formerly existed for students at the Institute, who were desirous of conferring with each other on the subject of their studies. The formation of the Society provided a room where students might readily confer with each other, and the gradual but certain supply of high-class scientific books to the library of the Society had given Institute students the opportunity of consulting the works of the best writers in all scientific subjects. Mr. Twigg further said—"I commend the ardent study of all science for its own sake, and think we ought not to content ourselves with taking such science as comes ready to our hand without making exploration in its domain for ourselves. With regard to Botany, for instance, it might be asked, What have we near at hand wherein original research can be made on this subject? I am no Botanist, and cannot presume to indicate the most likely fields for discovery, but I think I could find a green bank under any hedgerow, and place my hat on so much of it as would afford subject for inquiries of absorbing interest, on which I doubt whether any one could give me full information. Take an example. I pluck a small star-shaped flower, and show it a botanist. 'Oh yes,' he says, '*Bellis perennis*.' This is, doubtless, valuable information. I, however, know it as the common daisy; and what I wish to learn is, why the outer circle of the flower is white whilst its centre has a yellow colour, and, when partly satisfied on this point that it is considered to be so coloured in order to attract the visits of insects for the purpose of fertilisation, I proceed to enquire how the flower has become so entirely changed in colour from its green stalk, and where is the laboratory in which the process is conducted. Is it due to the power of light alone, or to some chemical quality? Waiting for an answer, I see near me the common dandelion in seed. What a graceful tuft of feathers is there, and what a contrast to the flower of the same plant. On attempting to gather it the slight motion causes the feathers to become detached and fly away! I am told that this is the method by which the seed is scattered; whereas the former plant seems to grow on from year to year in the same spot without any provision for becoming diffused. And why do we find the leaves of the daisy broad and even, and those of the dandelion long and deeply indented? I think I have indicated just a grain of sand on the seashore of investigation stretched before us, whilst there remains an infinity of speculation as to the vast area hidden to our view beyond the waves of eternity." Turning to another subject, Mr. Twigg said—"I have for a long time in leisure moments thought of the natural forces at our disposal, and asked myself the question, Do we make the best use of those at our command? We see primitive methods put into practice for utilizing the force of the wind, and the power of running water; but these suffer such frequent fluctuations that, since we have had the power of steam placed at our disposal, they have received little consideration, and remain in about the same state of improvement which they had reached a hundred years ago. Is steam, as now procured, our most readily available force, or is there not some other equally constant and more advantageous power? What can we do with the sea, situated as we are on an island indented with numerous channels subjected to its influence: even in an inland town like this we feel that it is at our doors. Cannot then something be done with the immense power of its daily tides, rising all around our coast, and exercising such a stupendous force that no diminution of it could possibly be experienced, no matter to what extent we might find it in our

power to utilize it? And when we also find it similarly exerted in such sheltered places as the Avon Gorge, where the violent storms of the sea coast would not be encountered, is there not some justification in hoping that a subject, which has been the day-dream of many others as well as myself, may at no distant date receive such attention as will render it no longer a mere visionary's idea?" The address was listened to with great attention, and a hearty vote of thanks was awarded to Mr. Twigg.

BIRMINGHAM SCHOOL NATURAL HISTORY SOCIETY. — This society, under the presidency of the Rev. A. R. Vardy, M.A., (Headmaster,) is in a thriving condition. The fortnightly general meetings have been held regularly throughout the year, at which papers have been read by various members, the chief of which are the following:—February 1st, "The Purple Loosestrife," by Mr. Levett; May 17th, "Coal: its Origin, Structure, and Distribution near Birmingham," by Mr. Atkins. The Society consists of forty-five members. President, Rev. A. R. Vardy, M.A.; Vice-presidents, Rev. E. F. MacCarthy, M.A., R. Levett, Esq., M.A., Rev. J. H. Smith, M.A., J. Turner, Esq. The Botanical Section has made two excursions, the first to Hagley and thence to Barnt Green, on April 24th; the second, on May 25th, to Haywoods, near Kingswood, where the following uncommon plants were found:—*Polygala depressa*, *Myosotis sylvatica*, *Convallaria majalis*, *Carex pendula*, in addition to ninety other species. Mr. Turner is president of this section. The Entomological Section has been doing some good work, under the presidency of Mr. Levett. Numerous rare and interesting specimens, brought by various members, have been exhibited at the Sectional Meetings. The Geological Section has also been working well, under the presidency of Mr. Atkins, having made excursions to Dudley and other places of interest in the neighbourhood, and having held Sectional Meetings regularly.

BURTON-ON-TRENT NATURAL HISTORY AND ARCHÆOLOGICAL SOCIETY.—The last excursion of the season was made on August 14th to Tamworth, Mr. W. C. Owen being leader. The church was first visited, where the Vicar, the Rev. Brooke Lambert, pointed out the objects of interest. The earliest portion of the church is of Norman date. In the tower is a double winding staircase of unique construction. The church, which contains many interesting monuments, has been lately restored. The parish register dates back to 1556. Tamworth Castle was next visited, Mr. Cooke, the present resident, kindly guiding the party. The Moat House, a fine old Elizabethan mansion, was next seen by permission of the owner, Mr. J. F. Woody. After tea, the party drove to Seckington, calling at Stalfold Hall to see the interesting chapel adjoining. At Seckington is a large mound and a series of entrenchments, supposed to be an ancient British earthwork. Mr. A. Clarson, of Tamworth, described it, and told what is known of it. The excursion was greatly enjoyed.

CARADOC FIELD CLUB.—The third Field Meeting was held at Lilleshall, on Tuesday, Aug. 27th. Heavy rain in the morning prevented more than a cursory examination of the geologic features of Lilleshall Hill, on which light has been cast by the recent labours of Dr. Callaway; but, as the weather cleared, a pleasant afternoon was spent in inspecting the ruins of the Abbey and a walk through the woods. Mr. R. W. Ralph (secretary of the Severn Valley Field Club) kindly and hospitably acted as guide through the day.

DUDLEY AND MIDLAND GEOLOGICAL AND SCIENTIFIC SOCIETY AND FIELD CLUB.—The sixth Field Meeting of the year was held on Tuesday and Wednesday, September 17th and 18th, at Chester and Northwich. A goodly party assembled at Chester, and accompanied by a large number of members of the local scientific societies, proceeded to Northwich under the guidance of Mr. Thos. Ward. By the courtesy of the Weaver Trust, a small steamer was in waiting to enable the visitors easily to go to the hydraulic canal lift at Anderton, which was explained by Mr. Wells, the engineer, and its action tried by most of

the party either riding up or down in the floating boats. The way was then taken to the Witton Salt Mines, which were illuminated, and the mode of blasting and working the rock salt was explained by Mr. Thompson, the owner, and great interest was taken in collecting specimens of the fine crystals reformed in the water remaining on the floor of the mine. Returning to Chester, all dined together at the Grosvenor Hotel, after which the Chester Society of Natural Science received the members at their Museum, where great preparation was made by collections of microscopic and other objects. A hearty welcome was expressed by Prof. Hughes, the President, and most interesting addresses were given by Messrs. Hughes, Shone, Shrubsole, and De Rance, on Local Antiquities, the Boulder Clay, the Origin of Salt, and Local Geology. On Wednesday, Mr. Hughes conducted the party around the walls of the city and the other objects of interest which so abound there. At the Town Hall, Mr. Jeafferson showed some of the more interesting of the public documents, which he is examining on behalf of the Historical Commission. After dining together at the Queen's Hotel, the party separated with hearty thanks to those who had received the Club and taken so much pains to make the visit one of exceptional interest.

EVESHAM FIELD NATURALISTS' CLUB.—On Saturday afternoon, August 31st, by the kind permission of E. C. Rudge, Esq., of the Abbey Manor, Evesham, the Club visited his grounds, and a very instructive and pleasant afternoon was spent in viewing his garden, greenhouse, and collection of curiosities, mostly dug up on the site of the Abbey. The party were accompanied by Mr. Herbert New, who gave some valuable information relating to Simon de Montfort, the Battle, the Abbey, &c. A meeting of the Club was held on Thursday evening, the 5th instant, Mr. J. S. Slater in the chair. It was decided to pay a visit to the Worcestershire Natural History Museum at Worcester, on Saturday, the 21st September. The annual meeting of the Club was arranged for Wednesday, the 23rd October.

NORTHAMPTON NATURAL HISTORY SOCIETY.—The principal field-day of the year was the one to Fotheringhay and Burleigh. A large party of members and friends proceeded on August 20th, by L. & N.-W.R., to Elton Station, and then walked to Fotheringhay Castle, of which but one fragment of masonry is left, although the general plan of the castle can still be made out. From the keep a very picturesque view is obtained over the valley towards Oundle, and the moat sides are interesting to Botanists, as being the only habitat in Northants for *Ranunculus parviflorus; Papaver somniferum*, *Hyoscyamus niger*, *Onopordon Acanthium* (relics of the old castle garden) were also found, the thistle being called by the villagers Queen Mary's Thistle. In what was once the castle yard a fine bush of *Cratægus oxyacanthoides* was noticed. A short description of the old castle having been given, the interesting church was next visited. There an owl was disturbed and flew about the churchyard, close to the members, affording a close view of a rarely day-flying bird. Vehicles conveyed the members by portions of the old woods of Bedford Turlieus, the borders of the forest here and there being festooned with *Clematis vitalba* in rich profusion. The woolly-headed thistle *C. eriophorus*, *Inula conyza*, *Calamintha menthifolia*, *Origanum vulgare*, *Campanula glomerata*, vars. *cærulea* and *alba*, and *Euphrasia officinalis*, were noticed passing Wansford, where *Verbascum nigrum* is to be found, and looking to the Nene specimens of *Sium latifolium* were seen. The party proceeded by the old north road to Thornhaugh, where the botanists left the party to visit Southorpe Marsh, and were well rewarded by finding *Juncus obtusiflorus*, *Carex flava*, *Schœnus nigricans*, *Menyanthes trifoliata*, *Parnassia palustris*, *Pedicularis palustris*, *Carex vesicaria*, *Eriophorum angustifolium*, *E. latifolium*, *Eupatorium cannabinum*, &c. The calcareous borders of the road from here to Southorpe Quarries yielded *Campanula glomerata*, *Asperula cynanchica*, *Gentiana Amarella*, and *Chlora perfoliata*, the same plants being found on the quarries of Southorpe and Barnack. These quarries are the most productive of all the Northants localities for rare plants in spring time, being covered with *Anemone Pulsatilla*, *Aceras anthropophora*, *Hippocrepis comosa*, *Astragalus hypoglottis*, *Antennaria dioica*, *Habenaria viridis*, &c., but in August, as was to be anticipated, a different flora

was observed, the most conspicuous plants being *Atropa Belladonna*, *Cynoglossum officinale*, *Gentiana Amarella*, var. *alba*; *Erythræa Centaurium*, a single specimen of *Hypochæris maculata*, *Calamintha Acinos*, *Verbascum nigrum*, &c. In the fields leading to Burleigh, *Centaurea cyanus*, (a rare Northants plant,) *Linaria minor*, *Stachys arvensis*, *Calamintha Acinos*, *Nepeta Cataria*, &c., were gathered. The Entomologists succeeded in capturing some fine *Cynthia cardui*, the Bedford Blue, the Red Admiral, and large Heath butterflies. Rejoining the party at Burleigh House, to visit which special permission had been given by the Marquis of Exeter, an hour was pleasantly spent in looking at the splendid collection of paintings, and the interesting state rooms with their relics of Queen Elizabeth and Treasurer Burleigh, after which but short time was spared for Stamford before tea, the return journey being by the Welland Valley and Market Harborough.

PETERBOROUGH NATURAL HISTORY SOCIETY.—A botanical excursion took place on July 4th. The river near Wansford Station was first visited, and yielded *Nymphæa alba* in abundance; then Stibbington Wood, where *Orchis pyramidalis*, *O. maculata*, *Vicia hirsuta*, *V. tetrasperma*, *Anthyllis vulneraria*, *Lathyrus pratensis*, *Prunella vulgaris*, *Erythræa Centaurium*, *Euphrasia officinalis*, *Hieracium Pilosella*, *Helianthemum vulgare*, *Tamus communis*, *Bryonia dioica*, *Centaurea Scabiosa*, *C. nigra*, *Scabiosa arvensis*, *Hypericum perfoliatum*, *Fragaria vesca*, *Festuca elatior* were collected. Leaving the wood and proceeding to the river, (through Stibbington village,) the banks of which were followed to Wansford Stanch, where *Stellaria glauca*, *Nuphar luteum*, *Thalictrum flavum*, and *Spiræa ulmaria* were gathered. Sutton Heath and adjoining meadows were next visited, when the following plants were collected: *Spiræa filipendula*, *Anagallis arvensis*, *A. tenella*, *Lychnis Githago*, *Centaurea Cyanus*, *Iris pseudacorus*, *Orchis conopsea*, *Pinguicula vulgaris*, *Samolus Valerandi*, *Lysimachia nummularia*, *Scrophularia nodosa*, *Pedicularis palustris*, *Ranunculus Flammula*, *Astragalus glycyphyllos*, *Melilotus officinalis*, *Poa pratensis*, *P. nivalis*, *P. nemoralis*, *Hordeum pratense*, *Cynosurus cristatus*, *Phleum pratense*, *Alopecurus geniculatus*, *A. pratensis*, *Briza media*, *Eriophorus polystachyon*, and *Equisetum limosum*.

TAMWORTH NATURAL HISTORY, GEOLOGICAL, AND ANTIQUARIAN SOCIETY.—At the general monthly meeting, held on the 2nd September, Mr. W. G. Davy, gave a description of the Wood Ants, (*Formica rufa*,) the largest of our British species. An account of the materials employed in the structure of their nests was given, and many instances of the wonderful economy of these insects recorded. He exhibited a large number of the ants in their nest within a glass case. Several donations were made to the Society's Museum, and the proceedings terminated with the usual vote of thanks.

WOOLHOPE NATURALISTS' FIELD CLUB.—August 22.—The fourth Field Meeting was held at Leominster, and the British camp at Croft Ambrey was visited. On arriving at the park gates leading to Croft Castle the party was met by the Rev. J. Edwards, Rector of Croft, who acted as leader. The celebrated grove of sweet chestnut trees was visited, and of the trees measured at the club level of five feet, one was found to be 20ft. 9in. in girth, and another, a magnificent specimen, 22ft. The latter has a long horizontal limb, about eight feet from the ground, 10ft. 8in. in girth. The church and its interesting monuments were inspected. The business of the Club was transacted at the British camp, which was carefully examined. The return was made through a lonely dingle, where many ferns were found. After a refreshing cup of tea at the Rectory, the party returned to Leominster and dined. Subsequently an interesting paper on "The Cedar Tree" was read by the President, (the Rev. H. W. Phillott, M.A.,) and another "On Remarkable Trees in the Neighbourhood of London" was contributed by Mr. Swinburne.

EXCHANGE.

Wanted *Alisma natans* and *Pyrus communis* in exchange for rare plants.—G. C. Druce, Northampton.

FRESHWATER LIFE.—III. INFUSORIA.

BY EDWIN SMITH, M.A.

If a little hay is steeped in water for a few days, and the infusion is then examined, it will be found to teem with microscopic life. Similarly the natural infusions offered by accumulations of water containing decaying animal and vegetable matter, or ponds where the simpler forms of vegetation flourish, are tenanted by countless millions of minute animals of various kinds, which, from their mode of occurrence, were named by the earliest observers *Infusoria*. The term at first included many organisms which, further investigation showed, could not be retained in the same class; plants mistaken for animals, because they moved about; animals of higher organisation, such as the Rotifera; others of a lower type, like the Amœba. This sifting process is even yet far from complete. It is not improbable that many forms now placed in this class, when their life history comes to be written, will have to be separated from the Infusoria properly so called. The number of species may also be reduced. For in the imperfection of our knowledge it is well to remember that forms which to-day are counted as distinct species may hereafter prove to be only different stages of the same animal.

Like other members of the sub-kingdom Protozoa, the creatures we are considering possess a simple body not divided into segments, and one which cannot be cut into two exactly corresponding halves. There is no definite alimentary canal, but digestion is effected indifferently in any portion of the fluid contents of the body. Pellets of food may be lodged in vacuoles extemporised in various parts of the interior, but they are not enclosed in stomachs separated by any sort of wall from the surrounding mass. Compared with other Protozoa, the *Infusoria* exhibit a more advanced differentiation of structure. The fluid protoplasm or sarcode, of which the bulk of the body consists, passes externally into a denser portion, the so-called cortical layer; which again is often protected by a still firmer covering termed the cuticle. Food is admitted by a distinct ciliated mouth opening into a short ciliated gullet, whence it passes, together with a small quantity of water, into the general body-cavity. When a proper mouth is not present, there is at least an oral region where a mouth may be extemporised. Refuse is excreted at a particular spot situated near to or remote from the mouth; but the discharging orifice is not, as a rule, permanently visible. One, two, or more contractile vesicles, having a fixed position in the cortical layer and connected with channels leading inwards, serve by their slow expansion and quick contraction to keep up a sort of circulation in the fluid interior, and to purify the sarcodic contents. In the same layer are found a nucleus, the female element, and, attached thereto, a nucleolus, the male element of the reproductive process. Reproduction takes place either by self-division lengthwise or crosswise, or by the conjugation of two individuals; the former method being characteristic of the sedentary, the latter of the free-swimming Infusoria. The same species may multiply in both ways.

With regard to external appendages, the three sub-groups of Infusoria are differently furnished. The *Flagellata* have one or two long filaments like a whip-lash; the *Acinetæ* have numerous radiating tubular tentacles, which act as suckers; and the *Ciliata* have vibratile cilia, employed as organs of prehension and locomotion. In the last group the cilia may be distributed over the whole body and be all of one kind, or widely scattered over the surface and of different kinds, or limited to the under side of the body, or placed in a circlet or short spiral round it. In some species the cilia all move in concert when the animal swims. In others only the smaller cilia at certain points appear to assist locomotion, while the larger resemble non-motile bristles and only occasionally move by the twitching of the superficial coat. Certain bell-shaped forms, *e.g.*, *Vorticella*, possess a tubular stalk by which they are attached to water-plants during the principal stage of their existence. This stalk contains a contractile thread, which, on the slightest shock, shortens into a spiral and jerks back the bell.

Of the ciliated kinds some have the power of secreting a soft gelatinous envelope or an open vase-like case, into which they retract and from which they extend themselves at pleasure. The case is mostly fixed by a very short stem, or by its closed end to some aquatic plant; but occasionally it is carried about by the animal, which has broken away from its support, and swims freely through the water. Many Infusoria, possibly all, undergo, at certain periods, what is called the encysting process; that is to say, they enshroud themselves for a time in a gelatinous covering, which hardens into a thin membrane, and meanwhile they become quiescent. The process appears to be subservient to preservation through the cold season, or to multiplication, or to metamorphosis.

To the above brief description of the class I will now subjoin a few notes on such common examples as have occurred to me in the ponds about Nottingham. *Stentor* may be looked for at all seasons in clear water covered with duck-weed. I have taken specimens in February during frosty weather. The body is trumpet-shaped when extended, but is drawn up at times into various figures from obtusely conical to ovate or globular. It often fixes itself by the narrow extremity, which spreads out a little adhesive foot for the purpose. When free, it swims with a moderately quick rolling motion. The surface of the whole body is covered from end to end with lines of minute cilia; while a broken spiral of longer ones surrounds the head with a wreath like a figure of six. The break in the wreath indicates the position of the mouth, near which may be noticed a contractile vesicle and its connected channels. I have occasionally seen three or four transparent vacuoles at a time bulging out from the side of the animal, but they did not contract. The nucleus, when I have observed it, has had the form of a horse-shoe. As to colour, my specimens have been either pellucid, or tinted dull blue, green, or even black, by their granular contents. The last were evidently specimens of *S. niger*, and were got from a pond in Bestwood Park; length, $\frac{1}{16}$ of an inch. It is interesting to notice diatoms, small animalcules, and so forth, in the food-vacuoles. Instances of self-division

or conjugation may often be observed; and I once met with a whole colony, produced by progressive self-division, all thrusting out their heads from the middle of a lump of jelly, which served as their common envelope.

The bell-shaped *Vorticellæ* are familiar to every microscopist, and they are as beautiful as they are common. They are often so abundant as to look like a white fluff clothing the roots and stems of aquatic plants. The bell has no cilia on its surface; but from the open rim protrudes a disk which bears a rotary wreath of these organs. In the depression between rim and disk lie the mouth and the excretory orifice close together. The former opens into a well-defined gullet, which extends some way into the interior, where also a contractile vesicle and a curved nucleus may readily be discerned. Careful illumination is needed to show the contractile thread inside the tubular stalk. When a Vorticella breaks away from its place of attachment, as not unfrequently happens, the bell may swim off with the stalk in tow. In one such instance I observed the bell come to rest by its cilia on a bit of weed; and while in that position, the stalk every now and then contracted spirally as usual, although the movement could be of no possible use to the creature. This led me to think that the movement is ordinarily quite independent of anything of the nature of will. Specimens may be met with in various stages of fission; and occasionally one or two small oval bodies are found adhering to the stalk where it joins the bell, but what part they play in the life-history of Vorticella I have not been able to witness.

Continuous self-division increases the number of individuals by a sort of geometrical progression. In such a way are probably formed those splendid compound clusters which, as in *Carchesium polypinum*, exhibit the magnificent spectacle of forty or fifty bells connected by their ramifying threads with one common trunk. It is a fine sight to behold a number of bunches all contract their fibres at the same moment to one centre, the top of their common pedicel, and to spread out again in loose array as before; and to see this done again and again, not by one specimen alone, but by a colony of specimens crowding the bit of water-plant under examination. I have taken Carchesium on *Anacharis* from under the ice in the month of January.

Minute Vorticelline forms are found in parasitic clusters on the carapaces of Cyclops, Daphnia, and other Entomostraca; on the shells of water-snails, on water-beetles, and on various aquatic larvæ. Not that the so-called parasites actually feed upon the substance of their host; they do not claim board, but only lodging. They feed in the surrounding element, as usual, by their cilia. *Epistylis digitalis* infests in thick masses the abdomen of Cyclops, having the appearance of an elegant but rather cumbersome train. The bell-part is $\frac{1}{430}$ of an inch long; the little stalk is branched and non-contractile. A much smaller species, with a simple stalk, has a length of no more than $\frac{1}{2323}$ of an inch. I have also met with a sessile form, filled with grains of chlorophyll, and completely colouring the abdomen of the unfortunate Cyclops green. Length of body from $\frac{1}{515}$ to $\frac{1}{1025}$ of an inch.

There is a family of Infusoria closely allied to the Vorticellæ in their form and habits, but distinguished by the absence of a stalk and by the possession of a roomy sheath resembling a very thin transparent vase, into which the animal can withdraw itself by a general contraction of the whole body. The two kinds with which I am acquainted are *Vaginicola* and *Cothurnia*. The sheath of the former is sessile; that of the latter is supported on a short stem. They multiply by self-division. Hence they frequently occur in pairs, each pair occupying a common vase. From the vase the twins protrude their ciliated crests by a simultaneous impulse, and after feeding awhile suddenly close up and shrink to the bottom of their cell. The retreat, however, is only momentary. Immediately they begin to rise again slowly and steadily, until they once more stretch forth to fish for prey. A contractile vesicle is situated not far from the mouth. The sheath of *Cothurnia* may be yellow, brown, or rusty red. I have seen *Vaginicola* sailing about, case and all, attached to a fragment of weed. Both kinds continue active through the winter.

[TO BE CONTINUED.]

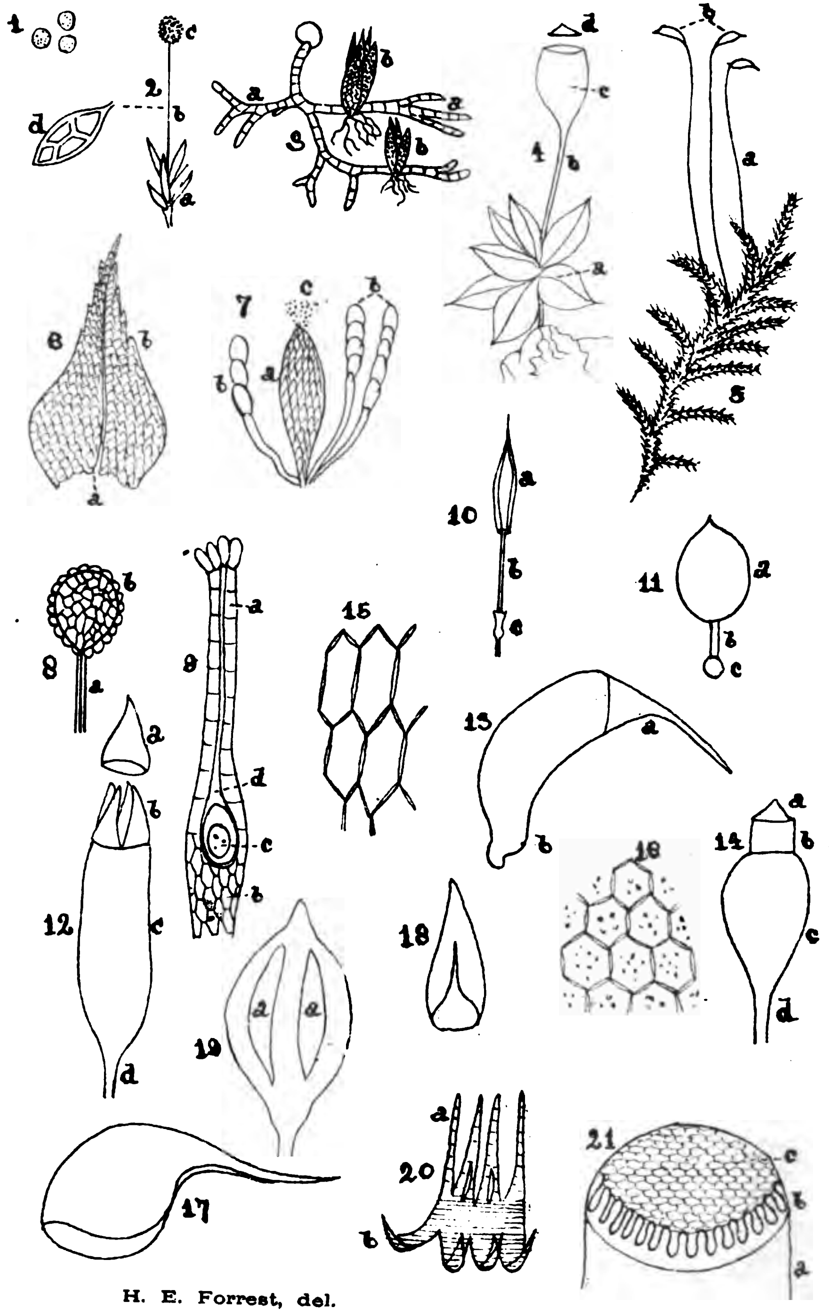
HOW WE FOUND THE MICROZOA IN THE BOULDER CLAYS OF CHESHIRE, &c., AND WHAT WERE THE RESULTS.

BY W. SHONE, ESQ., F.G.S.

During the early part of the year 1873 I had frequently washed the boulder clay of Chester for Foraminifera without success, until in September of that year my friend, Mr. J. B. Manning, (Governor of Chester Castle,) found in the upper boulder clay of Newton-by-Chester a boulder bored by *Saxicava rugosa*, in the cavities of which fragments of the shells remained. Wishing to possess these fragments, he proceeded to wash them out; but in doing so observed that the holes were not filled with the red clay in which the boulder was found, but with sand. Mr. Manning shortly afterwards showed me this sand, and as I was aware that the bore holes of recent Saxicavæ frequently contained sand full of Microzoa, which fills the space once occupied by the flesh of the Mollusc, I suggested we should go to our mutual friend, Mr. J. D. Siddall of Chester, and examine it. We did so, and, on placing the sand beneath the microscope, were rewarded with the sight of several shells of the Foraminifer—*Polystomella crispa*. Mr. Manning thereupon remarked "if we are to succeed in finding Foraminifera in the boulder clay we must look for stones with holes in them." I, at the time, thought this very hopeless, as out of the thousands of boulders I had examined this was the first that I had seen with cavities in it.

After parting with my friends that evening, it occurred to me that the turbinated shells of *Turritella terebra* would offer a still more effective shelter to the Microzoa. These were very abundant in the boulder clay of Chester, and I possessed a great number of them.

Plate IV.



H. E. Forrest, del.

On the study of Mosses.

This idea was further strengthened, as I had previously observed these shells were filled, not with the red clay in which they were found imbedded, but with a greyish-white sandy material—not occurring elsewhere in the boulder clays. So I put the idea that evening into practice by washing out, in a test tube, the substance which filled the inner whorls of the Turritellæ and other Gastropoda. After pouring off the fine muddy particles, there remained behind a fine sandy residuum which, on being placed beneath the microscope, I found to be *full* of Foraminifera, Ostracoda, Sponge spiculæ, and the spines of Echini. So thus was accomplished, after many unsuccessful attempts, the discovery of the Microzoa in the boulder clays.

The next question was, whether this was a mere local phenomenon, or was general in the boulder clays of the district. In order to determine this, in the spring of the following year, 1875, I made various excursions, and I found the Microzoa in the Gastropoda of the boulder clay of Madeley, in Staffordshire; Whitchurch (Salop,) Colwyn Bay (Denbighshire,) St. Asaph, Hawarden in Flintshire, Dawpool, Newton, (Cheshire,) also 700 feet above the sea at Macclesfield and Arnfield, (Cheshire,) Liverpool and other parts of Lancashire, the Isle of Man, &c.; in fact, wherever on the west coast I found Gastropoda in the boulder clay, the Microzoa abounded in the sand within them.

We then began to question ourselves how these Gastropoda became filled with the greyish-white sand, though they occurred imbedded in a matrix of red boulder clay? In the early part of 1875 there was a short, but, for the time, a very severe frost. At the mouth of the Dee there is an island, called Hilbre, some five acres in extent; it is distant about a mile and a half across the sands from the Cheshire shore. This space is covered with water at half tide. The dead shells of the Mollusca, Ostracoda, and Foraminifera, which live in the laminarian zone, are cast up and left by the receding tide between the ripple marks. The dead shells of the Gastropoda, as they lie in these hollows, get more or less filled with the *greyish-white* silt containing the Microzoa. The frost was severe enough to freeze the sea-water left by the tide in these hollows. Consequently the Gastropoda filled with this silt, the broken shells, &c., were enclosed in thin sheets of ice, which were broken up on the return of the tide, and such as were cast ashore on Hilbre Island were piled together and frozen into blocks. When the thaw commenced, it set the blocks free. Charged with the Gastropoda, filled with silt and broken shells, these tiny ice-rafts floated short distances away, distributing, as they melted, their load of broken shells, and casting the silt-filled Gastropoda over the mud flats of the delta of the Dee.

Recently Mr. R. D. Darbishire, B.A., F.G.S., gave me some silt containing Foraminifera, &c., gathered from the beach at Gorteen, Connemara, Ireland. My mother, Mrs. Shone, on examining this *debris*, observed that the fry of the Gastropoda, which abounded in it, were filled with this Foraminiferal silt, and only awaited the formation of ground ice on the shore, to transport them and repeat the phenomena of the Gastropoda of the boulder clays.

Thus, a flood of light was thrown on a subject which had puzzled even the late Professor Edward Forbes, who suggested the "ploughing up action of ice-bergs, and the sweeping action of great waves coming from the north." But the mud of the boulder clays required a still sea for its deposition; and its depth in Lancashire and Cheshire may be judged from the fact that the upper boulder clay of Macclesfield is 700 feet, and of Arnfield, Cheshire, upwards of 600 feet above the sea level; yet the broken and fragmentary shells of the Mollusca occur throughout at all levels, and are all littoral or sub-littoral in their habits—some living on rocks, others on sand, others on sea-weeds, yet found in a common matrix of red clay—none of the bivalves with valves united, and all more or less broken.

The presence of the glaciated erratics and arctic Mollusca tells us the climate was severe enough for the formation of ice in the winters along the then shores, when the north of England was sunk, perhaps, a thousand feet or more beneath the glacial sea; when glaciers ground their way down the valleys of Wales and the Lake district, sending forth their turbid streams of mud into the sea to form the boulder clays. Along these shores lived the Mollusca; from these shores the ice-rafts distributed them over the sea-bed, together with the glaciated stones with which they lie entombed, which bed, since upraised, has become the plains of Lancashire, Cheshire, and, perhaps, the Midland Counties. The granite boulders in the boulder clays of Lancashire and Cheshire have been traced to their sources in Eskdale, Cumberland, and Criffel, Scotland; and their distribution extends far beyond the limits of these counties, in a southerly direction. There is, therefore, a fair field of research open to the Midland Geologist in the boulder clays of those districts. The boulder clays of the north-west of England were once thought to be azoic, yet they have yielded to research a large fauna. In the upper boulder clay of Newton-by-Chester, I have found 148 species of Mollusca, Ostracoda, Foraminifera, &c., where no one thought of looking for a shell before 1873.

A word or two in conclusion may be spared for the middle sands and gravels, which occupy considerable areas in Lancashire and Cheshire. Professor Hull, M.A., F.R.S., was the first to observe that the drift clays and sands and gravels could be separated into three divisions—1st, in descending order—an upper boulder clay; then, 2nd, this was succeeded by (middle) sands and gravels; and, 3rd, a lower boulder clay. The physical features and the fauna of the upper and lower boulder clays are very similar, except that the lower boulder clay bears evidence of more glacial conditions than the upper. All the phenomena I have described are applicable to both clays. The middle sands and gravels differ from the boulder clays—first from the total absence in them (except near the mountains) of glaciated stones. The shells, too, of the Gastropoda are *not* filled with Microzoa, like those of the clays, but with the coarse sand or fine gravel, in which they are generally found embedded. The rolled character of the broken shells of the Mollusca also points to a different mode of distribution to those of the boulder clays.

The bands in which the shells occur in the middle sands and gravels bear evidence, too, of current bedding, all of which facts taken together with the presence of southern types of Mollusca, appear to indicate an inter-glacial period, when the sea was free from floating ice, and the glaciers—if any—ceased to pour into it the mud which formed the lower boulder clay. The partial denudation of the lower boulder clay, however, supplied the materials for the middle sands and gravels, together with the *derived* Arctic shells—sometimes found mingled with the southern ones in a common tomb. The agency which distributed the shells in the middle sands and gravels I believe, with Mr. De Rance, C.E., F.G.S., to have been marine currents.

All this, and more, came of the preserving of a pinch of sand out of the Saxicava-bored boulder found in the upper boulder clay of Newton-by-Chester.

Anyone wishing for the more detailed results will find them stated in my papers, viz.: In the Quarterly Journal of the Geological Society of London for May, 1874, on "The Discovery of Foraminifera in the Boulder Clays of Cheshire," and in the one for May, 1878, "On the Glacial Deposits of West Cheshire, together with Lists of the Fauna found in the Drift of Cheshire and adjoining counties."

PARASITES OF MAN.*

BY T. SPENCER COBBOLD, M.D., F.R.S.

[*Continued from page 213.*]

Considering the importance of the new parasite *(Filaria Bancrofti)* it was thought advisable to devote more space than usual to the literature of the subject; consequently, the remaining species of filariform nematodes may be dismissed with comparative brevity. It happens, moreover, that much doubt hangs over the question of the genuineness of several of the forms that require to be noticed. The human strongyloids, on the other hand, are all of them well defined species; and, as will be seen in the sequel, they play almost as important a *rôle* in the production of endemic disorders as do the Filariæ themselves. In a general sense, the Guinea-worm may be spoken of as a Filaria, but, for reasons given in my introductory treatise and elsewhere, I prefer to consider this parasite as the type of an osculant genus *(Dracunculus.)* The nematoids variously placed by helminthologists under the genera *Sclerostoma*, *Anchylostoma*, *Dochmius*, and so forth, are all of them closely related to the *Strongyli* properly so called. As regards the question of nomenclature, I must leave it to Mr. Grove to say whether, in the genera above mentioned, it is permissible for us to retain the final component *stoma* unaltered. Many continental helminthologists no

* Communicated by Mr. Hughes to the Microscopical Section of the Birmingham Natural History and Microscopical Society, October 15th, 1878. On Dr. Cobbold's behalf a microscopic slide was shown, containing numerous embryos of the Guinea worm. The young worms had been mounted some twenty-five years previously. They were originally taken from adult Dracunculi in the possession of the late Sir George Ballingall, of Edinburgh. Altogether the specimens had been preserved for upwards of half a century.

longer speak of the genera *Distoma*, *Tristoma*, *Polystoma*, *Sclerostoma*, and so forth; but, following Diesing, they prefer to convert the final Greek component into a true Latin syllable. Thus we have *Distomum*, *Polystomum*, *Sclerostomum*, and the like. Long habit has so fully familiarised us with the old plan of retaining the Greek termination unaltered, that I confess to some reluctance in parting with the final component *(stoma)* although the form is not strictly classical. On the other hand, the introduction of new and more striking departures from the legitimate method of employing the binomial nomenclature is much to be deprecated. Such a barbarism as *Hyperöodon butzkopf*, for example—intolerable as it must sound to the scholar's ear—is, nevertheless, freely accepted by well-known Naturalists both at home and abroad. In helminthology there are probably fewer glaring errors of nomenclature than occur in other departments of Natural History science. Nevertheless, I think Mr. Grove's criticism in the matter of the family term *Distomidæ* perfectly just.* Following the practice of the late Edward Forbes and others, I have frequently, and as I think fittingly, employed the names of *savans* for the purpose of forming new genera and species. Thus, by almost universal consent (on the Continent, at least,) my genus *Bilharzia* has been adopted; its general acceptance being in part due, no doubt, to the fact that, as a generic term, it had priority over the various other titles severally proposed by Diesing, Weinland, and Moquin-Tandon.

NEMATODA CONTINUED.

28.—*Filaria lentis*, Diesing.

Synonymy.—*Filaria oculi*, Owen; *F. oculi-humani*, Von Nordmann.

Remarks.—This small worm was originally discovered in a case of lenticular cataract, under the professional care of the distinguished oculist Von Gräfe. Similar cases have also been recorded by Jüngken and Sichel, by Gescheidt and Von Ammon, and by M. Fano. There is no certain evidence as to the sexual maturity of the worms obtained in these cases, although in one instance the parasite measured three-quarters of an inch in length.

Literature.—The standard works of Leuckart (l. c. Bd. II., s. 622,) and Davaine, (l. c. deuxième edit., p. 831,) and in my Entozoa, (p. 332.)

29.—*Filaria labialis*, Pane.

Syn.—None.

Remarks.—The original description of this species was based upon the "find" of a medical student at Naples. The worm (of which the female only is known) was an inch and a quarter in length, and occupied a pustular cavity in the upper lip.

Lit.—Quoted by Leuckart (s. 616) and Davaine, (Synops, c. VII..) from Pane's Nota di un elminte nematoide, in Annali dell. Accad. degli aspirante Naturaliste, Napoli, 1864, (Ser. 3, Vol. IV.)

30.—*Filaria hominis oris*, Leidy.

Syn.—None.

Remarks.—This apparently sexually immature worm was described by Prof. Leidy, from a specimen preserved in alcohol, and labelled as having been obtained from the mouth of a child. It measured five and a half inches in length.

* See the "Midland Naturalist" for May, p. 123.

Lit.—Leidy, J., in Proceed. Philad. Acad. Nat. Sci. for 1850, (p. 117.)

31.—*Filaria trachealis*, Bristowe.

Syn.—*Nematoideum tracheale*, Bristowe and Rainey.

Remarks.—Minute worms, each measuring about $\frac{1}{16}$ of an inch, were found by Rainey in the trachea and larynx, (post mortem.) Their mature condition is unknown.

Lit.—Bristowe and Rainey, in the Path. Soc. Trans. for 1855.

32.—*Filaria Loa*, Guyot.

Syn.—*F. oculi*, Gervais and Van Beneden; *F. lacrymalis*, Dubini; *F. medinensis*, Gmelin; *Dracunculus oculi*, Diesing; *D. Loa*, Cobbold.

Remarks.—This worm is found beneath the conjunctiva of negroes. It is rather more than 1¼in. in length; being particularly abundant in the Gaboon region of Western Africa. It has also been seen in Brazil and other countries. When the worm voluntarily quits the eye, a natural cure of the disease is thus produced.

Lit.—Fully noticed in the standard works of Leuckart, Küchenmeister, Davaine, Moquin-Tandon, and especially Gervais and Van Beneden. The descriptions are chiefly taken from the writings of Lestrille, Guyot, and Arrachart.

33.—*Dracunculus medinensis*, Cobbold.

Syn.—*Filaria dracunculus*, Bremser; *F. medinensis*, Gmelin; *Dracunculus*, Lister; *D. Persarum*, Kaempfer; *Furia*, Modeer; *Gordius*, Linnæus; *Vermis*, Grundler.

Intermediate Host.—The Russian traveller and helminthologist Fedschenko discovered that small freshwater crustaceans, of the genus *Cyclops*, harbour the larvæ of the Guinea-worm. In the free embryo stage these larvæ perforate the abdominal segments, and thence proceed to coil themselves within the limbs of the crustacean bearers.

Remarks.—The Guinea-worm disease, so common in India and other Oriental countries, is undoubtedly the same disorder as the Dracontiasis of Plutarch. It corresponds also with the Israelitish endemic affection described by Moses as due to fiery serpents. Küchenmeister's learned historical narrative leaves no room for doubt on this point. The older writers frequently confounded nematoid worms with serpents. As regards the mode of infection, there can be little doubt that the advanced larvæ of Dracunculus are swallowed with potable waters, and thus pass into the human stomach. Thence the female worms migrate to the surface of the body, in which situation they rapidly grow to maturity. The female parasite in its sexually mature state has been very fully anatomised by Professor Bastian. The embryos have likewise been carefully studied by Bastian, Busk, Carter, Fedschenko, Leuckart, Robin, Davaine, Lewis, and myself.

Lit.—All standard works, especially that of Leuckart, which offers an admirable *resumé* of the whole subject, including an exhaustive summary of Fedschenko's writings. Extensive literary references are given in Davaine's well-known work, and also in the Bibliography appended to my introductory treatise.

[TO BE CONTINUED.]

NOTE ON SOME FOSSILIFEROUS CLAY, AT WOLVERHAMPTON.

BY THE REV. H. W. CROSSKEY, F.G.S.

Some time ago I received an ounce or two of clay, which had been found in excavating a drain at Wolverhampton. On examination it yielded the following fauna:—

FORAMINIFERA.

Polystomella crispa. *Polymorphina lactea.*

Mr. H. B. Brady (who kindly examined the specimens) informs me that they are typical forms, far too widely distributed for anything positive as to habitat to be said about them, but that the chances are they belonged to a starved, shallow water marine fauna. They are more probably starved with cold rather than fresh water; and Mr. Brady would "guess" them Arctic rather than brackish.

MOLLUSCA.

Tellina balthica.—Fragments.

Dr. J. Gwyn Jeffreys obligingly examined these fragments, and states that "they must belong to *Tellina balthica*, because of their fleshy and loose calcareous texture." On the card to which I had affixed the fragments Mr. Jeffreys detected the minute portion of a univalve, which (he states) is "petrified and probably Liassic, being derived;" and refers to the paper by the Rev. W. Lister, "On the Drift, containing Recent Shells, in the neighbourhood of Wolverhampton," published in the "Quarterly Journal of the Geological Society," Vol. XVIII., p. 159. In this paper it is noted that in the drift at Bushbury Junction rolled shells and other fossils, derived from Liassic rocks, such as Gryphæa, Ammonites, Cardiniæ, and Belemnites, accompany *Nassa reticulata*, *Turritella communis*, *Purpura lapillus*, *Littorina squalida*, *Astarte Arctica*, *Cardium edule*, *Tellina solidula*, and *Cyprina Islandica*.

Of these species, two are decidedly Arctic, viz., *Astarte Arctica* and *Littorina squalida*, but the others are common to British and Arctic waters.

ECHINODERMATA.

Echinus —— ? Two spines.

These spines are too worn for the species to be determinable, but undoubtedly they are spines of an Echinoderm.

Dr. Jeffreys remarks generally upon the specimens submitted to him by Mr. Lister—"It is possible that these shells may have been carried off with the pebbles from a beach in the Arctic regions by an iceberg, which, after traversing a considerable distance in the glacial sea, may have stranded or melted and deposited its load in the spot where the shells and pebbles had now been found. The present data are, however, insufficient to enable me to form any opinion on this point."

The specimens now recorded do not enable any more decided opinion to be given. If not *in situ*, they must have been in the mud intermixed with the stones and boulders brought down by one of the numerous icebergs which stranded in this district. In either case, however, they add to the proof of the submergence of the Midland area during the last great geological epoch, and encourage us to hope that other shell beds may yet be found.

A SKETCH OF THE HISTORY OF THE LEICESTER LITERARY & PHILOSOPHICAL SOCIETY.

BY F. T. MOTT, F.R.G.S.

In the year 1835 two young men of Leicester, a physician and a lawyer, met at an evening party and discussed with unusual earnestness the condition and prospects of the town. It was a period of great political excitement; party passions separated friends and made general intercourse difficult. The question arose as to how this condition of things could be ameliorated. The young physician had recently been studying in Manchester, and described to his friend an institution of which he had been a member there, and which struck him as a useful means of bringing cultivated men together on a neutral platform This was the Manchester Literary and Philosophical Society. The lawyer listening to the physician's lively description of the beneficial action of that society, became inspired with a strong ambition to establish a similar institution in his own town. His friend entered warmly into the scheme, and they began at once to discuss preliminaries. It happened that in politics and theology they were diametrically opposed, but as the new Society was to ignore these irritating topics this was rather an advantage than otherwise.

It was agreed that each should invite half a dozen of his personal friends to a preliminary meeting to be held at the Medical Library in the month of June. At this meeting the Leicester Literary and Philosophical Society was established. Thirteen gentlemen were present, of whom six are still living; and among those six are the two founders of the Society —Dr. Shaw and Mr. Alfred Paget.

Dr. Shaw was elected its first President, and Mr. Paget its first Honorary Secretary. A room was engaged, a code of rules drawn up, and the first meeting of the Society was held on the 7th of September, 1835, when the President delivered an admirable opening address on the "Influence of Science upon the Happiness of Mankind."

At that time the population of the town was about 45,000, and the Society started with sixty members subscribing one guinea a year each.

The population is now about 120,000, and the members of the Society about 300.

For the first three years ladies were not admitted, and the attendance at the meetings, which were held monthly at half-past seven in the evening, varied from about ten to thirty.

During these three years many excellent papers were read before the Society, but occasionally a meeting was adjourned for want of an audience. The proposal to admit ladies was warmly debated at four successive meetings, and was at last carried.

At the meeting on October the 18th, 1838, each member was allowed to introduce one lady, and the advertisements and circulars of the succeeding session bore the words "ladies invited." At the same time the meetings began to be held fortnightly instead of monthly.

This change appears to have put new life into the Society. From that period it made continual progress both in numbers and in social influence.

In October, 1837, a dinner was given by the Society to Professor Sedgwick, who had come to Leicester to investigate the Geology of Charnwood Forest.

In the summer of 1841 the Society's Museum of Geology, Natural History, and Antiquities was established. In February, 1843, it had grown to such importance that it was resolved to give free admission to the public during three days a week, and Mr. John Plant, then a young man, was appointed Curator. Mr. Plant has since become well-known in the scientific world, as the Curator of the Peel Park Museum, Salford. The public were greatly interested in the opening of the Museum, 5,000 persons being admitted during the first fortnight.

In 1849 the Museum was handed over to the Town Council, who, having adopted the Museums Act, and levied a half-penny rate, purchased for its reception, at a cost of £3,000, a building erected twelve years previously for the Proprietary School. In this building it has remained for nearly thirty years.

The collection at that time contained about 10,000 objects. It has now about 22,000. Many of the original specimens, such as stuffed birds and insects, have decayed and been thrown away. In some cases this has happened twice over. Natural History specimens exposed to the light will only remain good for a limited period. The increase has, therefore, been more than would at first appear.

An arrangement was made between the Town Council and the Society, in an informal manner, not in writing, that the Society should retain the supervision of the Museum, should have rooms provided in the building for its meetings, should select the curator, and should pay £52 a year towards his salary. This arrangement, with slight modifications, was continued till the year 1872, and worked with remarkable smoothness and fair success. The half-penny rate, which realised at first only about £100 per annum, increased with the increase of the town, until in 1872 it produced about £450. But the whole of this was expended in salaries, repairs, new cases, and sundries. No specimens were purchased with it. The increase of the Museum collection depended entirely upon donations, a large part of which came from the Society, which continued to devote its funds to this purpose.

In 1872 a new *régime* was introduced, which is still in operation. The government of the Museum is now in the hands of a Special Committee, consisting of ten members of the Town Council, who appoint also six gentlemen, not members of the Corporation, as co-optative members of the Committee. The Council of the Society are entitled to recommend *four* of these six. The Committee thus constituted of sixteen members appoints six of its own body as Honorary Curators of the Museum, each with his own special department; and these Curators, who generally

include all the four co-optatives recommended by the Society, become practically the medium of communication between the Society and the Museum Committee.

The removal of the Society in 1849 to the rooms provided for it in the Museum was the beginning of a new era in its history. There was a great accession of members, the numbers soon rising from the former level of 90 or 100 to 150.

The Lecture Room, however, would barely seat 200, and it became necessary to limit the privileges of members in introducing friends.

For twenty years the Society kept steadily on its course, selecting its annual Presidents alternately from opposite political parties, though prohibiting political discussions on its platform; giving every season, from October to April, a course of about fifteen lectures, every one of them offered gratuitously mostly by members of the Society, and nearly all of a highly creditable character; and doing its part in a quiet way towards maintaining the higher education of the town.

But at last the interest and life of the Society began to flag, and the members to fall off. Several Presidents made spasmodic efforts to rekindle the general interest in the Society's work, but in 1870 a resolute and experienced organiser, the Rev. Robert Harley, F.R.S., was elected to the Presidential chair, and with remarkable skill and vigour completely rejuvenised the Society. Under his guidance and advice several plans previously projected or talked over were promptly carried out. It was decided to introduce into the annual course of lectures six by professional gentlemen of the highest reputation, regardless of cost; to establish an annual excursion in the month of May or June for the members and their friends; and to appoint a new officer under the title of Corresponding Secretary, who should be the prime minister of the President's government.

These, with other minor reforms, were completely successful in restoring the Society to health and progress. The number of members increased annually. The professional lectures were inaugurated by Professor Huxley, the largest public hall in the town being taken for the occasion and well filled.

The first excursion was devoted to the Geology of Charnwood Forest, under the able guidance of Mr. James Plant, F.G.S.

Hitherto the Society has done little in the way of publication. It has issued an annual report in a pamphlet of from thirty to fifty pages, and in 1855 a volume of 380 pages was published, containing *in extenso* a selection of seven lectures recently delivered before the Society. This volume was presented gratuitously to every member, but the expense was about £60, and the experiment was not continued. From a very early period of its history, the publication of its Transactions has been debated at intervals, but the necessity of devoting its funds to the Museum, and the feeling that the strength of the Society did not lie in the direction of original research, always prevented it. In 1875, however, it was resolved to collect the early records of the Society's work, and to publish them in brief abstract, in parts, to be issued at intervals until the current date was reached.

Of the Transactions in this form, four parts have been issued, including the fifteen sessions from 1835 to 1850, giving abstracts of a large number of papers, many of them of great local interest.

The Society was never more vigorous and flourishing than it is at the present moment. It has about 300 members subscribing a guinea each, about twenty lady associates subscribing half a guinea, and about twenty-five honorary members, all except one residing at a distance. Its sectional committees, established in 1849 for the pursuit of special branches of Art and Science, but most of which remained for many years in a dormant state, are wakening into real life. The Council have undertaken several additional courses of educational lectures for the general benefit of the town, as well as the members. The Corporation have recently provided, partly by public subscription, and partly from the borough estate, a new block of buildings in connection with the Museum, in which a very handsome Lecture Hall, seating 500 persons, is devoted to the use of the Society, and there can be little doubt that when the Midland Union holds its annual meeting in Leicester next May, it will receive a very warm and hearty welcome from the Literary and Philosophical Society, under the auspices of its President for the year, George Stevenson, Esq., who is one of its oldest and most valued members, an Alderman, and an ex-Mayor of the borough.

NOTE ON ŒCISTES PILULA.

At the meeting of the Birmingham Natural History and Microscopical Society, held June 11th, 1878, (see "Midland Naturalist" at p. 202,) I exhibited the very rare Rotifer *Melicerta pilula*, or, more correctly, *Œcistes pilula*, which I had then just found in Sutton Park. The history of this species appears to be as follows:—In the journal of the Quekett Club, 1868, this animal was described by Mr. J. G. Tatem as a *variety of Melicerta*, in which "only rudely shaped excrementitious masses adherent to the gelatinous investment are observed," but no distinctive specific name was suggested for it. This description was accompanied by drawings, which are fairly accurate so far as they go.

In "Science Gossip," 1872, Dr. F. Collins described the same organism as a new species, and gave a very incorrect account of it, stating that "the pellet with which the animal builds its tube is formed in a *kind of sac*, situated at the lower extremity of the abdomen," &c. In the "Monthly Microscopical Journal," July 1st, 1872, Mr. C. Cubitt takes this species as illustrative of the structural differences between Flosculariæ and Melicertidæ, and speaks of it as a form with which he had been acquainted for some years, and which he had called *M. pilula*, from the fact that "she fortifies the gelatinous basis of the theca with her own excrementitious pilules."

In this paper the author proposed to divide the whole thecated section of Rotifera into two families only, distinguished primarily by the

position of the marginal wreath of setæ and the cingulum or secondary belt of cilia and of the ganglion, relatively to a line or axis drawn from the mouth to the anus. Of these two families he proposed to make Melicertidæ include the genera Melicerta, Œcistes, Limnias, and Tubicolaria under the term Melicerta, while Conochilus, Lacinularia, and Megalotrocha were to be grouped together under the common name of Lacinularia.

But later observers have added several species to each of the old genera, the characters of which are sufficiently distinct to justify the retention of the older divisions. The difference of the form of the disc is a sufficient distinction between Melicerta on the one hand and Limnias and Œcistes on the other, while the two latter are separated by the different form of the lobes, the character of the theca, and their general habit.

If we accept the genus Œcistes at all, the species we are now describing should certainly be included in it. My friend, Dr. C. T. Hudson, says on this point—"They are Œcistes, and good specimens of the genus."

Mr. Cubitt's description of the singular habit of this animal is quite correct, but he does not appear to have observed the precise manner in which the remarkable operation is performed, from which it derives its name. It is self-evident that only a minority of the excrementary pellets discharged by the creature can be required or used to fortify its theca. The larger part are whirled away from the vicinity of the animal in the manner familiar to all who have observed the thecated Rotifers or the freshwater Polyzoa—but those which are utilised for building purposes are ejected between the rotifer and its tube or theca, and received under the lower margin of the ciliated trochus, where they remain for a few seconds as if the animal were making sure of its proper hold, and then by a sudden retraction of its body it dabs the pellet into a proper position on the margin of the theca, and instantly resumes its usual condition. The amount and regularity of the pellets with which the tube is fortified varies very much. One finds occasionally an individual in which they are so few and irregular as only to suffice for the identification of the species. Regular feeding with water containing abundant food produces a corresponding increase in their number and regularity, and a supply of carmine and indigo on alternate days is followed by the deposition of very regular alternate layers of red and blue courses on the outside of the tube, which, when viewed by strong dark background illumination, then forms a very pretty object.

My specimens produced abundant ova, which were formed in the usual manner in the ovary, and thence extruded into the space between the animal and its theca, and deposited upon the lower part of the foot, as is customary with this division of the Rotifera. I have not yet observed their development nor, although I have examined a large number of specimens, have I yet been fortunate enough to see the male of this species.

A. W. Wills.

Reviews.

The Geology of the Fenland. By S. B. J. SKERTCHLEY, F.G.S. London: Longmans and Co., 1877. 8vo. Price 40s.

ANOTHER Geological Survey Memoir of 335 pages, with some good maps, sections, and woodcuts, but which should have been issued at about half the price mentioned above. The Survey is supported by a Parliamentary grant, its officers receive nothing extra for the memoirs they write, the publication of which is, indeed, absolutely necessary if the public is to be put in possession of the information which it has a right to expect, and yet this is long delayed, and finally published in a badly got up style and at a high price, contrasting ill with similar publications of other nations, and even with those of our own colonies.

The Fenland embraces an area of about 1,300 square miles, lying round the Wash, and reaching to Wainfleet and Lincoln on the north, Stamford and Peterborough on the west, and Ely and King's Lynn on the south and east respectively. All this is a low flat country, under which lie the great Oolitic clays—the Kimmeridge and the Oxfordian. But upon these are spread a great thickness of boulder clay, and of gravel, peat, and silt of later date.

Mr. Skertchley has not confined himself to the strictly geological features of his district; he has considered, and rightly so, that the Archæology and the Physical Geography of the region are so closely bound up with the Geology that the one cannot properly be described without the other, and hence his memoir is, perhaps, the most readable which has ever been issued by the Survey. He has carefully studied old documents, and traces the history downwards, from the time of the Romans to that of the present day.

The oldest deposit noticed is the *Great Chalky Boulder Clay*. This varies from dark to light blue in colour, and is full of striated lumps of chalk; it also contains specimens of basalt, quartzite, coal-measure sandstone, Silurian limestone, slate, flint, &c. In a deep well sunk at Boston in 1828 this deposit was found to be of the enormous thickness of 460 feet. It was here underlain by sands and gravels (Middle Glacial) which were pierced to the depth of 88 feet, while it was overlaid by 24 feet of silt. The author strongly advocates the terrestrial origin of this boulder clay. He believes that it was formed underneath a great glacier, which came pushing down from the northward. In age he would correlate it with the *Lower Boulder Clay* of Lancashire. At Roslyn Hole, near Ely, a great mass of cretaceous rocks is described, which some Geologists have tried to account for by a complicated system of faults, but which Mr. Skertchley shows to be an enormous boulder, he having seen true boulder clay surrounding and underlying the whole. This transported mass is about 400 yards in length by 60 yards in breadth, and may be compared with the one at Ponton, through which the Great Northern line is cut, and with several of similar character in East Leicestershire and Lincolnshire.

Over the boulder clay we get true Fen deposits, first beds of gravel, and then layers of peat and silt. The two latter deposits inosculate, and there are at least three distinct beds of peat, which is largely composed of moss *(Hypnum fluitans.)* Buried forests are found on five horizons, and the manner in which the newer trees are found seated upon the broken stumps, or astride the prostrate trunks of the older ones, is extremely curious. The trunks of the buried trees almost invariably lie pointing to the north-east, and this is also the direction in which those now growing incline, except quite close to the sea coast, where the sea breezes assert their influence, and the trees all bend away from the water, as may be seen to perfection at Hunstanton. The silt is shown to be a marine deposit.

A great amount of information is given in the appendix, including 211 measurements of sections, and lists of inundations, rainfall, and local terms; also 120 titles of papers written on the district. Mr. Skertchley has done the main work, and in first-rate style, but he writes:—"I do not consider the Geology of the Fens to be by any means exhausted. Indeed, no one can be more sensible of the numerous points of interest barely hinted at or unnoticed; but an area of 1,300 square miles involves the work of a lifetime, instead of the four pleasant years I spent in the Fenland. . . The local peculiarities must be worked out independently by local Geologists, who will I trust find in this volume a conscientious and trustworthy guide." W. J. H.

Report of the Burton-upon-Trent Natural History and Archæological Society for 1877-8. Burton-upon-Trent: J. C. Perfect, 1878.

THIS Report bears the date 1878-9 on its cover, and also contains an abstract of an address delivered to the Society on "Nov. 27th, 1878," (p. 73,) from which it would appear that our Burton friends are "ahead of the times." At all events, there can be no doubt but that they are thoroughly well up with them, for the Report evinces a vigour and thoroughness which show that this young and active Society is doing good work in its district. In the account of the eight whole day excursions undertaken during the past year we note some interesting remarks on the grand oaks in Bagot's Park, Needwood Forest. That on Swilcar Lawn is 65ft. in height, and girths 26ft. at 4ft. above the surface of the ground. The branches of the "Beggar's Oak" stretch out for 108ft. from north to south, and 95ft. from east to west.

This Report contains also two excellent papers—one by the Rev. C. F. Thornewill, on "The History of Burton Abbey from its foundation (A.D. 1002) to the end of the Twelfth Century;" and another by Mr. J. T. Harris, on the "Economy and Natural History of Beetles, as Affecting our Grain and Vegetable Productions." A very valuable feature of the Society is the "Junior Section," composed of young students of Natural History, for whose encouragement prizes are annually offered for the best local collections of plants, shells, rocks, &c. We also note a Meteorological Table, showing the principal elements of the weather of 1877 in a concise form, prepared by the energetic Secretary, Mr. C. U. Tripp.

Tourists' Guide to Derbyshire. By J. CHARLES COX. London: Stanford. Price Two Shillings.

THIS is a guide book forming one of a series published by Mr. Stanford. It is not without defects, but it possesses many excellencies. To refer first to short-comings: The information as to inns is imperfect, and the distances are not always accurate. Several of the most picturesque bits in the county are not even mentioned; as instances of such omissions we may call the author's attention to the romantic road from Hayfield into Edale, Cave Dale at Castleton, Alport Castles, the head of Dove Dale, and the Lathkill Valley. A tone of depreciation of Derbyshire scenery is often assumed, which runs counter to popular judgment; as for example, the slur cast on Chee Dale and Monsal Dale. The lover of the moorlands also will certainly be surprised to learn that Kinder Scout and Axe Edge are not worth the trouble of ascending.

On the other hand, however, to the ecclesiologist the book will be invaluable; the descriptions of the churches are full and accurate; indeed, when we remember who is the author, praise becomes needless. In the Church Mr. Cox is thoroughly at home, and the reader gets the best information in the handiest form.

Coming to matters scientific we are glad to see a good description of Derbyshire Geology, and we can only regret that space seems to have prevented a similar chapter on the Botany of the county. The geological sketch is well done, and includes a reference to the important discoveries of Pleistocene mammalia and traces of Palæolithic man in the Derbyshire caves. It would have been as well had the high merit of the Rev. J. M. Mello, as discoverer of the Cresswell deposits, been recognised; the results of that exploration (the chief part of which was carried on by a committee under the superintendence of Professor Boyd Dawkins, whose valuable aid is not referred to) have been divided amongst the museums at Derby, Manchester, Castleton, Sheffield, and other places, and are not all at Derby as supposed by the author. The general conclusions drawn by Mr. Mello, Professor Busk, and Professor Dawkins are, however, stated with accuracy.

The reader will find frequent references to the monuments of prehistoric archæology which abound in the Peak. He may not believe them all to be of Celtic origin, or accept Mr. Fergusson's "Rude Stone Monuments" as any sort of an authority on British antiquities; but he will find Mr. Cox's descriptions very useful.

Altogether the book is a valuable addition to Derbyshire literature, and the stranger who uses it will find his way to many an object of interest or beauty which Black or Murray entirely ignore.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF SEPTEMBER, 1878.

BY W. JEROME HARRISON, F.G.S.

The first fortnight of the month was dry and pleasant weather, only broken by a severe thunderstorm on the 8th, in which at Pitsford 1·60 inches of rain fell between 6 30 A.M. and 9 A.M. In the same storm, ·33 inches fell at Bishop's Castle in ten minutes, ·66 inches in one hour at Shifnal, and 1·24 inches in one hour at Kinver. A severe westerly gale blew on the 15th, and was followed by showery and cloudy days to the end of the month. On the morning of the 30th, another heavy thunderstorm was experienced at most stations, doing much damage near Coventry, and largely denuding the trees of their leaves.

STATION.	OBSERVER.	RAINFALL. Total for M. In.	Greatest fall in 24 hours. In.	Date.	No. of rainy d.	TEMPERATURE. Greatest ht. Deg	Date.	Great'st cold. Deg	Date.
GLOUCESTERSHIRE.									
Cainscross, Stroud	W. B. Baker, Esq.	2·47	.84	7	18	88·0	8	8·60	21
Cheltenham	R. Tyrer, Esq.	2·58	·59	7	15	72·4	5	33·0	21
Stroud	S. J. Coley, Esq.	2·37	·76	8	11	70·0	6 & 7	37·0	21
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	3·03	·66	8	15	70·0	5	35·0	24
Whitchurch	A. B. George, Esq.	2·85	·70	21	13				
Woolstaston	Rev. E. D. Carr	2·80	.84	22	15	72·0	11	40·0	24
Leaton Vicarage, Shrewsbury	Rev. E. V. Pigott	·48	·89	8	15	72 1	5	32·0	24
More Rectory, Bishop's Castle	Rev. A. Male	2·00	·79	22	15	71·0	5	29·0	24
Larden Hall, Much Wenlock	Miss F. R. Boughton	2·43	·60	22	16				
Bishop's Castle	E. Griffiths Esq.	2·15	·65	22	13	78·0	11	35·0	24
Cardington	Rev. Wm. Elliot	2·33	·68	22	13				
Adderley Rectory	Rev. A. Corbet	2·82	·85	22	17				
Stokesay	Rev. J. D. La Touche	1·86	·66	22	10	78·6	6 & 11	32·8	24
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	2·75	·75	7	12			30·0	24
Stoke Bliss	Rev. G. E. Alexander	4·15	1·10	25	12	70·0	5 & 6	39 0	20, 23, 25
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq.	3·66	1·00	22	14	73·5	5, 6, 11	32·8	26
West Malvern	A. H. Hartland, Esq.	2·67	·82	22	12	74·5	6	38·5	20 & 25
Pedmore	E. B. Marten, Esq.	3·59	·84	22	14	71·0	5 (17	37·0	25
Stourbridge	Mr. J. Jeffries	4·13	1·04	7	18	74·0	3,4,5,6,7,	34·0	20 & 25
St. John's, Worcester	G. B. Wetheral, Esq.	2·96	·90	22	18	72·0	6	36 0	24
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	2·46	·72	22	16				
Barlaston	W. Scott, Esq.	3 05	·71	21	17	74·6	6	28·4	23
Amblecote	Mr. J. Robins	3·55	·76	22	13				
Dudley	Mr. J. Fisher	3 14	·72	22	18	74·0	2 & 5	36·0	20 & 21
Sedgley	Mr. C. Beale	2·22	·68	22	14	68·0	3 & 6	40·0	25
Kinver	Rev. W. H. Bolton	3·76	1·21	8	11	72·0	5 & 6	[illegible]	20 & 23
Walsall	Mr. N. E. Best	2·46	·45	22	15	68·0	8	38·0	23
Grammar School, Burton	C. U. Tripp, Esq.	2·10	·44	8	14	75·0	7	33 0	24
Patshull Gardens	Mr. T. W. Dell	2·60	·65	23	11	78·0	6	3[illegible]·0	24
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	2·82	·66	22	17	72·0	5	34·0	24
Wrottesley	E. Simpson, Esq.	2·75	·78	8	14	70·6	7	37·5	24
Tamworth	W. Arnold, Esq.	1·62	·45	8	11				
Tean Vicarage, near Cheadle	Rev. G. T. Ryves	2·77	·68	22	16	72·5	6	33·0	24
Heath House, Cheadle	J. G. Philips, Esq.	2·81	·60	22	12	69·0	6	39·0	20 & 26
Alstonfield Vicarage	Rev. W. H. Purchas	3·94	·40	15	15	71 1	11	35·0	24
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	2·44	·58	7	16	71·0	5	37·0	23
Coventry	J. Gulson, Esq.	2·92	1·27	7	13				
Bickenhill Vicarage	J. Ward, Esq.	2·75	·64	7	18	75·0	30	38·0	30
St. Mary's College, Oscott	Rev. S. J. Whitty	1·70	·87	22	14	72·7	11	34·9	24
Henley-in-Arden	T. H. G. Newton, Esq.	3·09	1·18	8	14	73·0	3, 5, 6, 11	34·0	24
Rugby School	Rev. T. N. Hutchinson	2·37	·96	7	17	73·6	6	36·0	26
DERBYSHIRE.									
Buxton	E. J. Sykes, Esq.	5·41	1·24	17	17	69·0	4	32·7	24
Stoney Middleton	Rev. U. Smith	3·40	.69	29	13	70 0	6 & 11	26·0	23
Fernslope, Belper	J. G. Jackson, Esq.	2·34	·38	29	17	71·0	4 & 6	37·0	24
Matlock Bath	R. Chadwick, jun., Esq.	3·09	·66	29	12	67·5	3 & 6	36·0	24
Linacre Reservoir, Ches'field	C. E. Jones, Esq.	2·60	·95	30	9				
Willesley Gardens, Cromford	J. Tissington, Esq.	2·88	·6	29	11				
Stuffynwood Hall	Mr. R. Rolfe	1·75	·35	22	14	71·0	4	38·0	23
Spondon	J. T. Barber, Esq.	2·24	·58	7	11				
YORKSHIRE.									
Healey Hall	B. J. Whitaker, Esq.	2·68	·81	30	15	74·0	7	38·0	24
NOTTINGHAMSHIRE.									
Hodsock Priory, Worksop	H. Mellish, Esq.	1·92	·44	29	13	72·9	6	34·9	24
Grove House, Mansfield	W. Tyrer, Esq.	1·54	·32	22	14	71·8	4	35·5	24
Tuxford	J. N. Dufty, Esq.	2·15	·18	22		72·0	7	3[illegible]·0	23 & 24
Park Hill, Nottingham	H. F. Johnson, Esq.	1·60	·45	29	11	69·3	3 & 4	37·8	23
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	1·64	·33	22	18	74·6	11	33·4	24
Ashby Magna	Rev. E. Willes	1·81	·83	8	13	72·0	5 & 7	39·0	24
Market Harborough	S. W. Cox, Esq.	2·05	·50	7	12	72·0	7	31·0	24
Kibworth	T. Macauley, Esq.	1·91	·49	8	14				
Town Museum, Leicester	W. J. Harrison, Esq.	1·82	·45	7	14	70·8	3, 6, 7	33·6	24
Belmont Villas, Leicester	H. Billson, Esq.	1·92	·80	22				35·5	24
Syston	J. Hames, jun., Esq.	1·48	·36	22	16	72·0	7	38·0	24 & 25
Waltham-le-Wold	E. Ball, Esq.	1·51	·21	29	11	67·0	29	36·0	26
Little Dalby Hall	G. Jones, Esq.	1·26	·21	22	12	76·0	4 & 7	34·0	24
Coston Rectory, Molton	Rev. A. M. Rendell	1·27	·27	29	13	70·0	6	29·5	24
Belvoir Castle	W. Ingram, Esq.	1·65	·27	1	14	73·0	7	35·0	21
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	1·59	·71	7	7				
Castle Ashby	R. G. Scriven, Esq.	1·41	·26	7	18	78·0	5	40·0	23
Pitsford	C. A. Markham, Esq.	1·77	1·60	7	16	80·0	5	32·0	24
Kettering	J. Wallis, Esq.	1·02	·25	22	11	72·0	6	41·0	24
Althorpe	W. F. Jakeman, Esq.	2·24	1·29	7	11	71·0	3 & 6	34 0	23
Northampton	H. Terry, Esq.	2·24	1·31	7	15	75·0	5	37·0	23
RUTLAND.									
Burley-on-the-Hill	W. Temple, Esq.	1·77	·31	9	15	72·0	6	37·0	18
West Deyne, Uppingham	Rev. G. H. Mullins	1·12	·27	25	8	74·5	5	38 1	26
Northfields, Stamford	W. Hayes, Esq.	1·56	·46	8	9	70·0	7	32·0	20
Radcliffe Observatory, Oxford	Mr. H. E. Bellamy	1·85	·87	19	10	78·2	5	35·2	23
Spital Cemetery, Carlisle	T. Bell, Esq.	4·15	1·04	22	19	74·5	5	35 0	20
Ventnor Hospital	H. Sagar, Esq.	1·91	·63	17	11	74·2	6	45·8	20
Altarnun Vicarage	Rev. G. Tripp	4·51	·93	8	19	80·0	6	42·0	13, 23, 26

The rainfall on the whole is below the average for the month, and so too is the temperature. The barometer has been unsteady, and westerly winds have blown on about twenty-four days, thus largely preponderating. Solar halos are recorded from Oxford on the 3rd and 4th, and lunar halos on the 3rd, 13th, and 16th. A fine aurora was seen at Cheltenham on the night of the 6th, the luminous streams reaching quite up to the zenith. The last swallows left the neighbourhood of Stroud on the 30th, and the same date is recorded for their departure from Coventry. Probably the storm of that day was the signal for a general exodus of these feathered migrants. On the 29th six snipe were seen in the meadows by the River Nene. Near Stroud the wood strawberry (*Fragaria vesca*) was seen in blossom, and (unripe) fruit on the 19th. Several observers remark on the comparative absence of butterflies this season.

Correspondence.

White Variety of Harebell.—It will, perhaps, be interesting to "H." (page 106) to know that I have found during the past summer several white specimens of the *Campanula rotundifolia*, within six miles of Aberystwith. They were all of a pure white, and, though there was an abundance of the blue, I could in no place find any of a shade between the two. Last year I found a specimen of the primrose, perfectly white, near Barnt Green.—H. D.

Nottinghamshire Ferns.—Perhaps the following list of ferns found in North Nottinghamshire will be interesting to some readers of the "Midland Naturalist." They have all been found either at Pleasley Vale, (Notts. side,) Creswell Crags, (Notts. side,) or the Woods at Welbeck, by Mr. R. A. Rolfe :—*Polypodium vulgare*, *Polystichum angulare*, *Lastrea filix-mas*, *L. cristata*, *L. dilatata*, *Athyrium filix-fœmina*, *Asplenium ruta-muraria*, *A. trichomanes*, *Scolopendrium vulgare*, *Pteris aquilina*, and *Cystopteris fragilis*.—C. T. Musson.

The Cuckoo's Note.—In Norfolk they have a saying—

In May he sings all day.
In June he changes his tune.
In July away he'll fly.
In August go he must.

I believe that this is a tolerably correct account of his proceedings; and I suppose that the action in July is borne out by his being seen on the wing in that month more than in the other months.—G. B. R. B., Nottingham.

Junior Members.—It has often occurred to me that it would be a wise plan if our Natural History Societies would offer facilities for intelligent youths, under eighteen years of age, to become members, (they might be called associates,) for in them would, I feel sure, be found the best material out of which valuable working members of the future would naturally be developed. As youths are not usually overburdened with money, the subscription they should be called upon to pay should be as nearly nominal as possible; at the same time they should be treated with encouraging courtesy to warm them to working pitch. They should be made to feel that they are valued, and good results would invariably ensue. I have no hesitation in asking the Societies to give the subject due consideration.—B. W. E.

NOTTINGHAMSHIRE CONCHOLOGY.—Two specimens of *Testacella Maugei* have been found at Welbeck, in Nottinghamshire, by Mr. R. A. Rolfe. In company with that gentleman I found the following species of shells which I have never hitherto found in Nottinghamshire :—*Clausilia laminata*—one specimen only at Pleasley Vale. *Helix lapicida*—seven dead specimens at Pleasley Vale, and fifteen at Creswell Crags, and after a long search at the latter place I succeeded in finding one live specimen. *Cochlicopa tridens*—three specimens at Pleasley Vale. Of species that I have before found in Nottinghamshire, I also found on this occasion *Helix caperata*, plentiful at Creswell Crags. *Bulimus obscurus*, rare, at Pleasley Vale and Creswell Crags. *Helix aculeata*, rare, at Creswell Crags. *Vertigo pygmæa*, rare, at Creswell Crags. *Pupa umbilicata*, very plentiful in the same locality. I am not aware that either *Clausilia laminata*, *Helix lapicida*, or *Testacella Maugei* have ever before been found in Nottinghamshire. I should be glad to hear if they have been found in other localities.—C. T. MUSSON, 68, Goldsmith Street, Nottingham.

BORINGS IN LIMESTONE ROCKS.—In a geological walk, lately taken across Derbyshire, I kept a close look out for those cylindrical holes in limestone masses about which an animated correspondence took place in the "Geological Magazine" (Vols. VII. and IX.) a few years ago. Walking at the rate of twenty miles a day does not allow a very close examination of the rocks *en route*, and I saw nothing of the objects of my search till I reached Arbor Low, (or Arbelow as it is sometimes spelt,) the fine Druidical circle which occupies an elevated and lonely hill-top between Hartington and Youlgreave. Here we have a raised ring of earth, about 80 yards in diameter, formed of material thrown up from the inside, where, accordingly, there is a corresponding fosse or hollow, mound and hollow being each three or four yards wide. In the centre (which is at the natural level) we find oblong masses of limestone, lying in a circle, with a central mass or altar-stone. Whether these limestone blocks were originally set upright or not I do not know; I should imagine that they were, but now they all lie flat, and, owing to centuries of weathering, their surfaces and edges are much worn and fretted. Crawling along on the grass, and examining the under surfaces of projecting ledges, I was much pleased to find some very fine examples of the burrows or "lithodomous perforations," as they have been termed. They were truly circular, about an inch in diameter, and from one to two inches deep. In the controversy which raged in the "Geological Magazine" these burrows were assigned by one party to the marine bivalve shell *Pholas*, but by others to the common land snail, *Helix*. In the former case they were done when the land was depressed below the level of the sea, and must date back many thousands or tens of thousands of years. If, however, they are the work of *Helices*, their formation may be comparatively recent; and, in fact, may still be going on. My discovery of these burrows on the Druidical stones which form the circle of Arbor Low, seems to me to settle the question in favour of the *Helices*, for the stones are, undoubtedly, artificially blocked-out masses, rectangular in outline, though they have suffered much from weathering. The snail, it appears to me, decomposes the limestone by means of an acid secretion, aided by the action of its cartilaginous toothed strap or *odontophore*, (palatal organ,) which was also the view advocated by Mr. John Rofe. The burrows which I examined were empty, but I believe they are made and used by the *Helices* as places of hibernation or shelter, and they should be examined again in winter. It is very desirable that the creature should be watched in the act of excavation, and its secretions tested for acid by means of blue litmus paper. Here is a task for any patient observers dwelling in mountain limestone districts. I should be pleased to hear if any other observers have noticed these burrows.—W. J. HARRISON, Leicester, August 9th.

Artizan Naturalists.—The following extracts are taken from a letter written by a Leicester stocking-maker, George Robson, who has found means for self-cultivation while bringing up a large family on the earnings of his frame. There are probably not a dozen men in Leicester of all classes who know as much about the Natural History of the district as he does, and none who love Nature more truly and reverently.—F. T. Mott.

"I have at last managed to pay, once more, a visit to the home of *Oreopteris*, and you will be pleased to learn that it is not extinct in our forest yet, but even flourishes more plentifully than before. It is very pleasing to know that I did not aid in obliterating one species of our native flora from our much-loved Charnwood. I would be a *sower* of grass, not a *mower;* a builder up, not like a dark iconoclast, a breaker of God's own artwork. Last year there seemed to be but little of the fern *Oreopteris* growing near the wood, and, as you thought, it seemed to be dwindling out; but on reaching the lane last Sunday I was very much surprised to find so many plants scattered along the wall that forms the boundary of the wood. Indeed, I was much in doubt at first whether they were not seedlings of *N. Filix-mas*. There were at least twenty roots of it in the ditch, off which I brought about a dozen fronds. Enclosed are specimens, so that you may verify it yourself. *Scutellaria minor* was also very plentiful at the foot of Old John Hill, and what was more surprising was to find *Hydrocotyle vulgaris* growing wonderfully fine in the lane, near the *Oreopteris*, even finer than at Groby Pool. Enclosed, too, is a specimen of *Polypodium calcareum*, from Miller's Dale, Derbyshire, which may interest you. I have paid two visits to this district this year. The hills and vales are magnificently grand, both in shine and storm, for I have seen them in both, and shall never forget the awful beauty of a thunderstorm witnessed from the Heights of Abraham. The storm-clouds came up the vale like night advancing in column. They seemed to reach from earth to sky, first grasping the hills, then enwrapping all in Cimmerian darkness. As it approached, the great rain-drops fell heavy and fast. It was like a mighty and evil spirit ushered in by furies. The jagged lightning ran up the dark as though a band of elastic fire had been stretched from heaven to earth, and suddenly let go, the whole stroke being in view. The storm moved past, and then came another sight I had never before beheld. The sun gleamed forth, and there, right below, was a beautiful rainbow stretching the whole length of the Dale, and parallel with the river. It really seemed like being in another sphere to have a rainbow at our feet. What a rush of feeling takes possession of one mid such scenes as these, where we are shown new wonders, new beauties, and grandeur on every hand. We both take a new flight of thought and feeling ourselves, and are enabled to better appreciate the deepened thought of others. One could scarcely witness such scenes as these without thinking of Byron, who courted nature in her anger, and who has, perhaps, given us the best description of a thunderstorm. Then the sunshine, and the rainbow! One, who had read it, would almost be sure to think, on witnessing such a scene, of that beautiful simile in Eliza Cook's poem—

> I'd climb on any rainbow bridge,
> To let my heart look farther out.

And truly the soul does seem to look farther out, to be with nature in all her wildness, and to be, as it were, nearer to God. The botany of Matlock Bath is very rich and rare. *Geum rivale* grows in the street; *Cardamine impatiens* along the Derwent, on the Lover's Walk, with many others; and on the hills any amount of *Thlaspi alpestre*, var. *virens*, can be got. The botany of Miller's Dale was rather disappointing, but the geology is grand. There was plenty of such ferns as *Cystopteris fragilis*

Aspidium aculeatum, and the one enclosed, which is the rarest. *Centaurea scabiosa* and *Solidago virgaurea* waved from the wall-like rocks everywhere. I was fortunate enough to meet with three Ashton-under-Lyne botanists who were acquainted with the district. They said the Dale was very rich in *Cruciferæ* in the early summer and spring. They pointed out a spot where a Mr. Whitehead had found a new sedge. It was on a tunnel between Monsal Dale and Cressbrook, but I had not time to visit the place. From conversation that passed it seems working men in that district are much before the Leicester working men as Naturalists, and they meet with more encouragement from the upper classes. They gave me a card on which is a list of names of landowners who have given them liberty to go over their grounds, and nearly at the top is our own Lord Stamford. To come back to our own hunting ground. Enclosed is a curious rush from Bradgate Park which I don't quite understand. It seems to be an instance of exuberance of growth, or chloranthy, I think you call it. I have a specimen of white clover similar in growth, also a bifid frond of *N. filix-mas*. I am told there are specimens of *Scolopendrium* on the Narborough Road with trifid fronds. I intend going to see them. But, perhaps, the greatest curiosity of the year was a sparrow I had. Its wings and tail were white, with a white ring round the throat. It could not peck, nor was it full feathered when caught. My intention was to keep it a while, and on being hung out of doors in a cage it caused much amusement by the old birds coming regularly to feed it. They seemed to sympathise with it and make a great to do. If it was taken in the house at night they—that is the old birds—would come in through the window when left open very early in the morning, and often the younger members of the family, too, to feed and condole with it. It knocked itself about much in the cage, so when it could peck it was turned in an empty room where I thought it would soon get fine, but the silly thing fretted and died.—G. R., 92, Cranbourne Street, Leicester."

Gleanings.

Herefordshire Pomona.—The first part of this magnificent work has just been issued. It is the work of the Woolhope Naturalists' Field Club. In our next number we hope to give some account of it. In the meantime we urge all who are interested in the cultivation of hardy fruits to buy the book.

Birmingham Library.—The Committee have recently issued a supplement to the catalogue of books added from April, 1876, to December, 1877; and to this is subjoined an "experimental classified index of subjects," prepared by the Librarian, Mr. Charles E. Scarse. We are led to make this announcement, in order to point out that this classified index is but the outcome of a recent rearrangement of the books in the Birmingham Library in Subjects, the books in each division being further arranged alphabetically as to authors. Mr. Scarse, in undertaking this arduous task, (the library contains upwards of 50,000 volumes,) was encouraged by the hope that he would thus render the treasures of the library much more accessible to young students than they were previously. A public library, the books in which are thus classified, must obviously be a great boon to those whose knowledge of literature is more or less limited. We have carefully examined the large collection of Scientific books, (each science being separately arranged,) and find them so disposed, that in whatever department information may be desired it is at once and readily accessible. Mr. Scarse has executed this work most satisfactorily, and he has set an example which may be advantageously followed in other public libraries.

MIDLAND UNION.—The Small Heath Literary and Scientific Society has joined the Midland Union of Natural History Societies.

EXAMINATION OF GLACIAL DEPOSITS (Scheme proposed by Mr. W. J. Harrison, F.G.S.)—At a meeting of the Geological Section of the Birmingham Natural History and Microscopical Society, on October 22nd, it was unanimously resolved that the Section should take part in the suggested examination. The Rev. H. W. Crosskey, F.G.S., (who kindly undertook to act as Secretary,) will be glad to receive communications on the subject from local observers, addressed to 28, George Road, Edgbaston, Birmingham.

THOSE INTERESTED IN THE PROGRESS OF NATURAL SCIENCE at our old Universities should take notice of the fact that, after considerable opposition of the "Board of Studies of the Natural Science School," the majority of that Board (chiefly by the aid of the examiners, who are London, and not Oxford, men) have carried a series of resolutions which provide that "candidates for honours in Biology" may be examined in Experimental Physiology. The necessary encouragement to the study of this subject, viz., examination in it as an "honour subject" now existing, we may hope to see as the result some activity in the Physiological Laboratory of Magdalen College. Similarly we have to notice the recognition of the Morphology and Physiology of the vegetable kingdom as a necessary part of the study and examination of the Oxford student who is a candidate for "honours in Biology." Botany was long resisted and sneered at in Oxford. External pressure has, however, reinstated Botany in the Oxford School of Natural Science, and it rests with the examiners in future to maintain the study of this subject in the direction indicated by Sachs' admirable treatise on Botany published by the University press.—*Nature.*

ROMAN MILESTONE.—The most perfect miliare, or Roman milestone, yet found in Great Britain is that in the Leicester Town Museum. It is cylindrical in form, and is fashioned out of the coarse sandstone known as millstone grit. It is 3ft. 2in. in height and 5ft. 6in. in circumference. It bears the inscription:—

IMP CAES.
DIV TRAIANI PARTH. F. DIV. NER. NEP.
TRAIAN. HADRIAN. AVG. P.P. TRIB.
POT. IV. COS III. A. RATIS
II

showing that it was erected in the year A.D. 120, during the reign of the Emperor Hadrian, at a distance of two miles from the station of Ratae (Leicester.) The letters are from 2in. to 4in. in height, deeply cut and quite distinct. It was probably erected to commemorate the visit of the Emperor to Britain. It was found in 1771 close to the road from Leicester to Melton, (the Roman Fosse-way,) and was at first destined for a garden-roller! Rescued from this fate, it stood for forty years in the centre of the town of Leicester, but fortunately escaped any serious injury, and finally found a safe resting-place in the Museum. In the same room with this fine object of antiquity is a smaller stone cylinder, measuring 1ft. 9in. in height by 4ft. in girth. It bears the letters IMP only, and was found at Six Hills, (also on the Fosse-way,) about ten miles north of Leicester, in 1854. When this stone was seen by a well-known antiquarian, he remarked that he was once much puzzled when examining the neighbourhood of the Roman Wall in Northumberland by hearing the natives speak of an "Imp stone." When they took him to see it, he found it was one of these rude milestones. Altogether about fifty-four of these Roman milestones have now been found in Britain, of which the fine specimen above described is the earliest in date so far as is known.

Botanical Locality Record Club.—The officers of this Club have issued an appeal, asking the co-operation of Botanists in general, but more especially of Bryologists, to aid in a scheme for investigating the geographical distribution of Mosses in the British Isles. Mr. C. P. Hobkirk, F.L.S., and Mr. H. Boswell, have consented to act as recorders. The subscription is 5s. per annum. When thirty additional Botanists have joined the Club, the funds will justify the issue of a report on mosses. Names should be sent to Dr. H. F. Parsons, Goole; or Mr. C. P. Hobkirk, F.L.S., Huddersfield. We trust some of our readers may be induced to join this useful Club.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—Biological Section.—August 18th. This meeting was devoted principally to the exhibition by Mr. W. R. Hughes of the specimens taken by members of the society during their recent excursion to Arran, and to a summary of its general results. As a detailed report will be presented to the society when the examination of these specimens is completed, it will suffice for the present to state that among them are numerous representatives of the principal orders of marine animals, from Rhizopoda to Pisces, many of them of very high interest. Mr. Hughes also showed on behalf of Mr. Simpson, of Wylde Green, the egg of the common Tortoise, *Testudo Græca*, laid in that gentleman's garden by a tortoise lately placed there, and being one of seven which she deposited between eight A.M. and seven P.M., in holes about four inches deep scooped out in the soil. It was nearly spherical, and of a pure white colour; also, on behalf of Mr. C. J. Woodward, eggs of Cuttle-fish, *Sepia officinalis*, from Bournemouth. The outer shell of one of these being removed, the contained embryo forms a beautiful object when viewed in the microscope by dark back-ground illumination. Mr. Short contributed specimens of the flower of *Agave Americana*, from Sir R. Wallace's gardens, in Suffolk, (see ante page 254.) A large number of botanical specimens were also exhibited by Messrs. J. Bagnall, G. Caldwell, T. Butterfield, and others.—Biological Section.—September 10th. Mr. A. W. Wills showed on behalf of Mr. Wm. Spencer a remarkable specimen of an oyster shell, bought by that gentleman as apparently containing a pearl, but which on being split open was found to enclose a small but perfect individual of the genus *Pinnotheres pisum*, a crab belonging to the decapodous short-tailed crustacea. This animal inhabits the shells of living bivalves, such as the common mussel, cockle, oyster, &c. One species of this genus inhabits the large Pinna of the Mediterranean, and was well known to the ancients, who believed that a kind of "commensalism" existed between the two animals, the crab warning the mollusc of approaching danger, and receiving house room and shelter as a *quid pro quo*. Mr. Spencer also contributed specimens in which a small pebble and the operculum of a Turbo had respectively been covered with the pearly secretion. In the course of the discussion which ensued, Mr. W. Graham mentioned that the natives of the Chinese seas are in the habit of preparing small leaden images of Buddha, which, being inserted between the mantle and the shell of certain species of oyster, are covered with nacre and then sold as charms. The thanks of the section were unanimously accorded to Mr. Spencer for his interesting contribution.—At the same meeting Mr. Bolton exhibited a small submerged leaf of Bladder-wort, (*Utricularia vulgaris*,) with a crown animalcule (*Stephanoceros Eichhornii*) attached to it, together with many specimens of *Melicerta ringens*, *Limnias ceratophylli*, and *Œcistes crystallinus*, a *Philodina*, and a *Brachionus*. In addition to the preceding Rotifers, this little bit of weed, although not exceeding a quarter of an inch square, was covered with numerous attached specimens of Infusoria, including several species of *Vorticella*, *Carchesium polypinum*, three species of *Epistylis*, *Stentor Mülleri*, *Cothurnia imberbis*, *Dendrosoma radians*, and two other species of *Acineta*. This was the only piece of weed he had found time to examine under the microscope out of a

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large collection he had made the previous day in a locality near Chester, to which he had been kindly introduced by Mr. Chantrell, the President of the Liverpool Microscopical Society, as a locality now abounding in a beautiful Rotifer *Lacinularia socialis*, and in a variety of fresh-water Polyzoa, of which Mr. Bolton also exhibited some specimens. The next day Mr. Bolton found on the same bit of weed the flower animalcule, *(Floscularia cornuta,)* another species of Rotifer, and afterwards *Cephalosiphon limnias*, and great numbers of the new collar-bearing flagellate monads, discovered and described by Mr. W. Saville Kent.—September 17th.—MICROSCOPICAL GENERAL MEETING. Mr. H. E. Forrest exhibited living specimens of *Spirorbis nautiloides*, a marine Annelid, showing compound ciliated tentacles, operculum, &c. Mrs. Robinson, a lady who has recently returned from India, exhibited and described a very interesting and extensive collection of specimens, consisting of ferns, butterflies, reptiles, &c.—24th September.—GEOLOGICAL SECTION. Mr. W. R. Hughes, on behalf of Mr. Councillor Pattison, showed interesting specimens of fossil wood and shells from Budleigh Salterton. Mr. W. Graham exhibited some specimens of rocks collected during the excursion to Eastnor and Malvern. Mr. S. Allport mentioned that he had prepared a section of one of them, and it showed that the rock was a fine grained hornblendic rock greatly altered. Mr. W. Graham and Mr. C. Pumphrey communicated an offer made by the Rev. W. G. Symonds of named specimens of the rocks of the Malvern district, for the purpose of microscopical and general examination. The Secretary was directed to accept the offer with thanks.—General Specimens exhibited by Mr. Levick and Mr. Forrest included (among others) from near Barnt Green:—*Lacinularia socialis*, *Dendrosoma radians*, *Chætospira Mülleri*, *Stephanoceros Eichhornii*, and *Polyarthra platyptera*. By Mr. Slatter, *Verbascum Blattaria*, the fruit of the cherry laurel. Mr. Southall, *Utricularia minor* and *U. intermedia*, the latter being very rare. Mr. Wilkinson showed some monstrosities in radishes.—October 1st.—GENERAL MEETING. Mr. Bagnall exhibited some bladders of *Utricularia minor*, &c. Mr. W. Southall exhibited *Phalaris arundinacea* infected by ergot, *(Claviceps purpurea.)* Mr. S. Allport exhibited specimens of the Malvern rocks, consisting of contorted Mica-schist, hornblendic gneissoid rock, containing bitumen and syenite from the North Hill. Mr. C. T. Parsons exhibited *Lycium barbatum* in fruit from Alton. Mr. T. Bolton exhibited *Philodina roseola* with *Protococcus pluvialis*, both in the motile and quiescent state, from Handsworth. Mr. H. E. Forrest exhibited living specimens of *Zoothamnium*, a lovely species of Vorticella, *Stephanoceros Eichhornii*, *Lacinularia socialis*, and other rare Rotifers all on one twig; also *Stentor* in the act of self division.—October 8th.—BIOLOGICAL SECTION. A number of interesting objects were exhibited. These included mounted specimens ot *Carchesium polypinum*, which had been killed by immersion in hot water, contributed by Mr. T. Bolton; branched colonies of *Limnias ceratophylli*, containing about twenty individuals, shown by Mr. H. E. Forrest; and a series of microscopic preparations of *Utricularia*, by Mr. J. E. Bagnall, showing the bladders *in situ*, and illustrating the structure of the valves and of the peculiar quadrifid processes. Mr. Bagnall accompanied the exhibition of his very interesting collection by notes on the geographical distribution of Utricularæ, and by remarks on the structure and function of the bladders, recording the result of observations many of which were made previous to the publication of Mr. Darwin's researches on the same subject. Mr. A. W. Wills exhibited the rare Rotifer *Melicerta*, or more properly *Œcistes pilula*, which he had shown under some disadvantage at a previous meeting, and referred to the classification of the thecated section of the Rotifers proposed by Mr. Cubitt, and to the structure of the genera Melicerta and Œcistes respectively, as justifying the inclusion of the species now referred to in the latter genus. Also a Rotifer belonging to the same genus, and secreting a large semi-transparent theca, also found in Sutton Park, and apparently identical with or closely resembling a species described by Mr. Oxley at a recent meeting of the Royal Microscopical Society. As no name appears to have been proposed for this animal, Mr. Wills suggested that it should be called *Œ. longipes*, from the great length of its slender foot.—October 15th.—MICROSCOPICAL GENERAL MEETING. Mr. Bolton exhibited *Chætophora endiviæfolia*, one of the fresh-water algæ, sent by Mr. Chantrell, president of the Liverpool Microscopical Society. Mr. Simcox exhibited a partition of *Nautilus*, ornamented by a native of New Caledonia; a large caterpillar, found with several others, three feet deep, in a creek near Sydney, N.S.W.; and a large operculum, and other parts

of shells, from the waters of Sydney. He also exhibited a section of Steatite, (rare,) from the Bleak Head, Lizard. Mr. W. R. Hughes, F.L.S., read, on behalf of Dr. Spencer Cobbold, F.R.S., a further instalment of his valuable communication on "The Parasites of Man," (see p. 295.)

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY. —September 2nd. A party of members left Snow Hill for Coalbrookdale, whence they proceeded to Maw's Encaustic Tile Works, where, by special permission, they were shown the various processes of making the tiles. The moulding of the tiles from a nearly dry powder by simple pressure, making them fit to be put at once into the kiln, occasioned much surprise. The various processes of putting the patterns on and glazing the tiles were then inspected, and much interest was shown in the forming the seggars out of powdered fire-clay by a pressure of 140 tons. The party then proceeded to Benthall Hall, where Mr. G. Maw kindly showed them the many objects of interest in the hall, and also the fine collection of foreign plants in the garden. Benthall Edge was descended to Buildwas, the well-preserved Abbey visited, and an adjournment then made to the Bridge Inn for refreshment. Here Dr. Callaway joined the party, and led the way to Shineton Brook, where are the exposures of shale described by that gentleman in the August number of the "Midland Naturalist." Numerous impressions of trilobites *(Asaphus Homphrayi)* were found; and the party then proceeded to Cressage, whence the return was made at 7 20.—October 9th. Mr. C. J. Watson read an interesting paper to the members, entitled "Scientific Jottings on the Continent."

CARADOC FIELD CLUB.—The last Field Meeting of the season, specially devoted to the study of Cryptogamic Botany, was held at Downton Castle, near Ludlow, on Wednesday, September 25th. In spite of a rainy morning, there was a fair attendance of members. Several rare specimens of Fungi, amongst others *Clavaria amethystina*, *Lycoperdon echinatum*, *Strobilomyces strobilaceus* were collected on the walk through the woods, which were thrown open to the party by the courtesy of A. R. Boughton Knight, Esq. After dinner at the Feathers Hotel, Ludlow, a paper "On the Cup-Funguses of Shropshire" was read by Mr. W. Phillips, and Mr. J. P. Blunt made some remarks in continuation of a paper read last year, on the researches which he and Dr. Downes are pursuing in regard to the influence of "Light on Bacteria." This was a highly successful meeting.

CHELTENHAM NATURAL SCIENCE SOCIETY.—This Society held its Annual Meeting on Thursday, the 4th October, when T. Wright, Esq., M.D., F.R.S., &c., was unanimously re-elected President for the session of 1878 and 1879. Col. Basevi was also re-elected Honorary Secretary, and the following gentlemen the Committee of Management:—Major Barnard, F.L.S., F. Day, Esq., F.L.S., F.Z.S., H. Elwes, Esq., F.L.S., F.Z.S., G. Ferguson, Esq., M.D., H. A. James, Esq., Sir Brook Kay, Bart., R. M. Lingwood, Esq., F. D. Longe, Esq., F.G.S., Dr. F. Maier, and T Wilson, Esq., M.D. The accounts for the past year were read and passed. October 17th.—General Meeting. Major General Cox presided, in the unavoidable absence of Dr. T. Wright, F.R.S., through severe domestic affliction. The minutes of the meeting on the 4th inst. were read and confirmed. Ballot was taken for the admission of three members. Mr. Badger's circular, dated 26th September, relating to Mr. Harrison's interesting paper on the Glacial Deposits was read, and copies of the paper distributed. Major Barnard read a most interesting paper on "New Zealand: Botanical and Zoological." A cordial vote of thanks was awarded. The paper was illustrated by some specimens of curious birds and dried ferns, and the author drew comparison between the ferns of New Zealand and of England.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.— Natural Science Section.—September 20th. Mr. E. Wilson, F.G.S., exhibited a fractured quartzite pebble, containing a clear cast of the Caradoc fossil, *Orthis redux*. The pebble was recently picked up by Mr. J. H. Jennings, of the High School, from a roadside heap of broken quartzites, on the south of Bulwell Forest, near Nottingham. It was not therefore *in situ*, but was probably derived from the subjacent Bunter conglomerate of the district (see "Geological

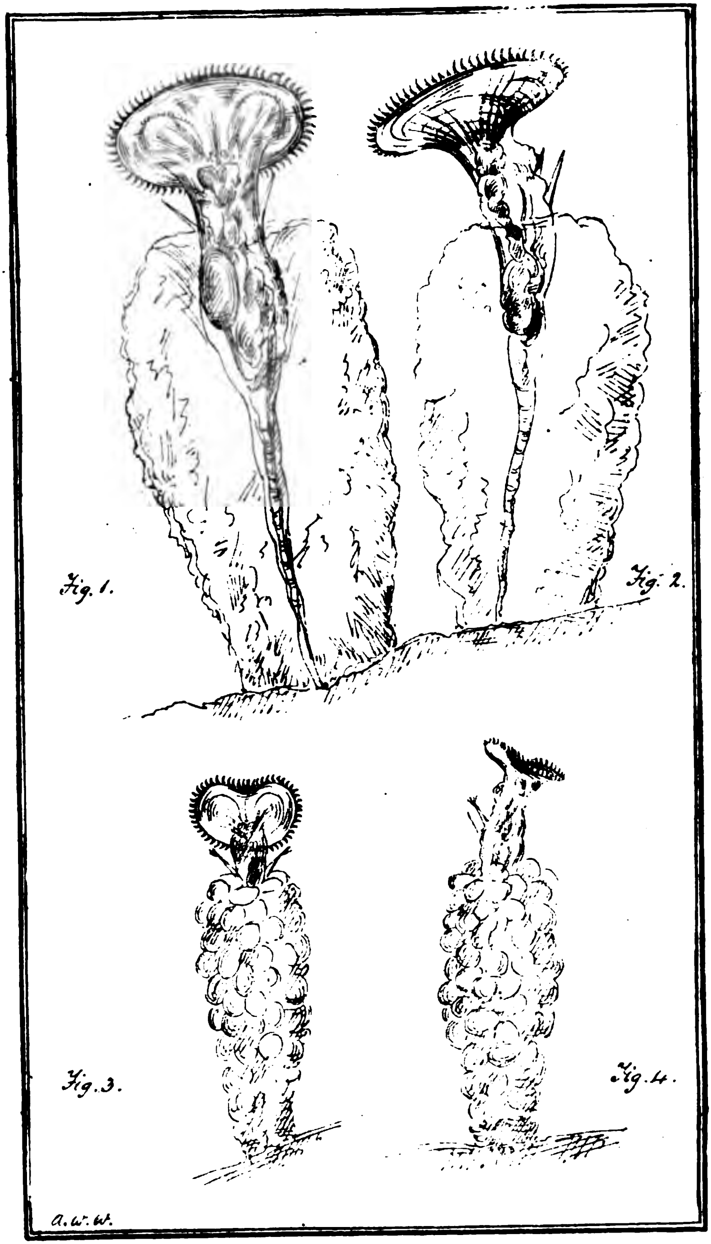
Magazine," for May, 1878.) Mr. Musson exhibited a fossiliferous piece of quartzite, found by him resting on the Bunter conglomerate of Nottingham "Forest." Mr. Wilson also exhibited a fine specimen of *Ceratodus altus*, found by him some time since in the "bone bed," present in the Rhætic (*Avicula contorta)* Shales, recently exposed in the Barnston cutting, on the new line, near Bingham, Notts. This section was visited by the members about a year ago. Mr. Wilson also noted the occurrence of the same genus (once thought to be confined to the Aust locality) at Stanton-on-the-Wolds, near Nottingham, at Leicester, and another locality. He pointed out its affinities to the fossil genera *Ctenodus* and *Dipterus*, and to the modern *Ceratodus* of Australia. September 27th.—Mr. H. Marshall Ward read a valuable paper on "Starch, and its Uses in Plant Life." October 5th.—A Geological Excursion was made to Froghall, Caldon Low, and Alton. Arriving at Froghall at 9 40 A.M., the members spent some time in examining the "Froghall hæmatite," which is worked in this district, and which occurs near the base of the "coal-measures" series of the Cheadle Coalfield. A ride up the tramway then brought the party to the Caldon Low Quarry. This quarry is in the lower beds of the "mountain limestone," and in one part of the quarry the "white sands and clays" lying underneath the boulder clay were seen. These beds are also well exposed in the Ribden Pit, (near the base of the Weaver Hills,) which was next visited. An interesting walk, *via* Cotton, brought the party to Alton, where a luncheon at the "Shrewsbury" terminated a very pleasant excursion.

NOTTINGHAM NATURALISTS' SOCIETY.—Meetings have been held during the last month as follows:—September 18th, when Mr. L. Lee gave a lecture on "The Lower Forms of Vegetable Life." October 9th, Microscopical evening. October 16th, Lecture on "Coal," by Mr. C. T. Musson.

STROUD NATURAL HISTORY SOCIETY.—October 8th.—First Meeting of Session. A paper was read by Mr. J. A. Tannahill on "Bees and their Habits." A short description of some scientific objects in the Paris Exhibition was given by the President, Chas Playne, Esq., followed by a brief account of some kinds of Entozoa by Dr. Partridge, the secretary, illustrated by drawings and specimens.

WOOLHOPE NATURALISTS' FIELD CLUB.—The usual annual Fungus Foray took place on October 3rd. There was a large attendance, including many scientific visitors from a distance. The members and visitors drove to the lawns of Sufton Court, and were very kindly received by Mr. Hereford. The mycologists were soon successfully occupied in the woods, whilst the less scientific portion of the company wandered up the hill to the British Camp at Adam's Rocks, Backbury Hill. Later in the day a meeting of the members was held in the Club Room, at the Free Library, Hereford, when the following officers were elected for the ensuing year:—President, Mr. Arthur Armitage; Vice-Presidents, Rev. W. H. Phillott, Mr. W. A. Swinburne, Rev. A. Ley, and Rev. G. M. Metcalf; the Central Committee, Messrs. T. Curley, J. Griffith Morris, C. G. Martin, and O. Shellard; Treasurer, Mr. Cam; Auditors, Messrs. J. Davies and J. T. Owen Fowler; Secretary, Mr. Theo. Lane. The annual dinner took place at the Green Dragon, when the two funguses, *Hygrophorus pratensis* and *Agaricus nebulosus* were served to the guests. The latter, which is one that is rarely eaten, proved to be a species well worthy of the occasion. Dr. Bull, after dinner, gave the cordial welcome of the Club to the scientific strangers present, and then gave a report on the progress of Mycology during the past year. The Rev. Augustus Ley read a carefully prepared paper on "The Mosses of Herefordshire," which was very highly applauded for the results of real work in the fields which it contained, and which was ordered to be printed in the Transactions of the Club. A soirée was held in the evening at the house of the Treasurer, Mr. Cam, which was well attended by the members and visitors. Dr. Cooke read an elaborate paper on the genus *Corticium*, with observations on the modes of distinguishing the British species. Mr. Phillips, of Shrewsbury, described a new Peziza, (*P. crucifera,)* which gave rise to a long and animated discussion. The Rev. J. E. Vize exhibited an *Æcidium* from the Cape of Good Hope, one of the finest of its tribe. He showed a number of other interesting objects under the microscope.

Plate V.



NOTE ON A THECATED ROTIFER FROM SUTTON PARK.

The last number of the "Midland Naturalist" contained a description of the rare Rotifer *Œcistes pilula*, which I first exhibited at a meeting of the Birmingham Natural History and Microscopical Society on the 11th of June last. The same pool in Sutton Park, whence I obtained that species, has since yielded a thecated Rotifer of large size and singular beauty, apparently not yet described, unless indeed it be identical with one recently shown by Mr. Oxley at a meeting of the Royal Microscopical Society, of which Mr. T. Bolton exhibited a drawing at the June meeting of the Birmingham Society. In the absence of all measurements it is difficult to decide whether these two animals represent the same species, but the diameter of the trochus in Mr. Oxley's drawing appears greater than it is in my specimens, and the latter clearly show two tentacular processes, while his figures show only one, though this may result merely from the position in which the animal was sketched. But as both my observations and drawings were made before I had heard of that gentleman's, I beg leave to append a brief description, together with figures drawn under the microscope to an accurate scale, premising that, as I have only found two individuals, such description is necessarily imperfect, and that I hope next season to be able to renew my observations.

If the species has not yet received a name, I would suggest that, from the length of its slender foot-stalk, it may be appropriately christened *Œcistes longipes*.

I also give figures of *Œcistes pilula*, drawn to the same scale.

Œcistes longipes.—Total length of animal when fully extended, ·045in.; when retracted, ·026in.; diameter of trochus, ·014in.; height of theca, ·035in.; greatest diameter of theca, ·029in. Theca semi-transparent, milky-white when viewed by dark back-ground illumination. Cilia of the circular trochus conspicuous, those of the cingulum clearly visible under a 1in. objective. Mastax occupying more than half the diameter of the neck. Tentacular processes two, apparently without terminal setæ.

Ova carried after emission at base of foot-stalk. Foot-stalk corrugated, especially when retracted.

Œcistes pilula.—Dimensions of an average specimen:—Total length of animal when fully extended ·025in.; longer diameter of trochus, ·005in.; shorter diameter, ·003; height of theca, ·018in.; greatest diameter of theca, ·007in.

A. W. Wills.

Description of Figures.—Plate V.

Figs. 1 and 2.—*Œcistes longipes*.

Figs. 3 and 4.—*Œcistes pilula*.

MOSS HABITATS.

BY JAMES E. BAGNALL.

(Continued from page 272.)

A moss-grown tree is always an attractive object to me, and many a pleasant hour has been spent looking over these mossy invaders in search of some rare or local species. The trees most prolific in moss tenants in Warwickshire, (better known to me than any other county,) are the ash, elm, lime, Ontario poplar, sycamore, and apple. The oak is often moss-grown, but not to the extent of the above-mentioned, nor are its inhabitants so truly tree-loving species. On the beech and the coniferæ I rarely find mosses. In other climates these also have their special tenants. The mosses which I should designate tree-loving mosses are such as the *Orthotrichums*, *Cryphæa*, *Leucodon sciuroides*, *Zygodon*, *Weissia cirrhata*, *Leskea polycarpa*, &c.

The Orthotrichums are very distinct looking mosses, occurring in larger or smaller tufts. The fruit-stalks are very short and usually hidden by the surrounding leaves. The capsules with one exception are striated or streaked, and always erect, the calyptra bell-shaped, longitudinally plaited, and more or less covered with erect hairs, the leaves in most cases erect when dry, and more or less covered with minute papillæ, and the leaf margin in most cases turned over towards the upper surface or involute, leaf cells roundish. If the above characters are borne in mind they will be great helps.

Orthotrichum affine will be found frequently on the ash, elm, and poplar in large, loose, dark green tufts, a rather coarse-looking moss, with a pale yellowish-green calyptra. The capsule is oblong, pale brown, with a longish straight beak when ripe, but becomes whitish and somewhat spindle-shaped when dry.

O. Lyellii is abundant here on the elm and ash, forms large yellowish-green loose tufts, has the leaves much recurved when moist, twisted when dry, the leaf margins plane, and both surfaces covered with prominent papillæ or minute elevations, and much clothed with brownish jointed conferva-like processes. The fruit very rare.

O. diaphanum will be found on many habitats, trees, old palings, walls, &c. It grows in small bright-green tufts, and has the leaves terminated by translucent toothed whitish tips.

O. leiocarpum is rare in the Midlands, and is readily known from the other species by the capsule, which is quite smooth, *i.e.*, without striæ, when dry. This I find on the Ontario poplar.

The Ulotas have most of the characteristics of the Orthotrichums, but have usually more hairy calyptras, and narrower leaves, much crisped when dry.

Ulota crispa, which occurs on both elm and ash, forms little yellowish-green tufts, and has the leaves much twisted when dry. From May to July is the best season for all the above in perfect fruit.

Cryphæa heteromalla is a local moss, occurring mostly on the ash, has a creeping pinnate stem, fruiting branches erect, the capsule immersed n the surrounding leaves, the calyptra conical, brownish, and the fringe or peristome white; fruiting in June.

Leucodon sciuroides I find upon the ash, elm, and apple trees, often very abundant, but very rarely fruiting. This species has also a creeping stem, with numerous erect shoots; the leaves are spreading when moist, but imbricate (overlapping) when dry; the shoots are thickened at the end and incurved, and the leaves are nerveless; marginal leaf cells round, central ones oblong.

In calcareous and marly soils I find the yellowish-green tufts of *Zygodon viridissimus* not unfrequently on the lower part of the trunks of elm, ash, and sometimes oak trees; when moist and fresh-gathered the leaves are spreading, but when dry they are crisped and somewhat twisted; the leaves are widely lance-shaped, have plane margins, very small dot-like cells, and a pellucid nerve. I have not seen this in fruit, but it should be sought for in spring.

Weissia cirrhata is an abundant moss on trees, gate-posts, and rails, forming dark-green cushions. The leaves are lanceolate, with the margins turned over towards the underside, crisped when dry, leaf cells minute and opaque; the capsule is terminal, borne on a short, straight foot-stalk, has a long straight beak, and a fringe of sixteen rudimentary teeth.

Leskea polycarpa I have found most frequently on the roots of willows, especially near water, but it also occurs in drier habitats. It forms matted yellowish-green tufts; the stem is creeping, somewhat divided with pinnate branches, leaves spreading, somewhat oval in shape, slightly roughened or papillose on the back, leaf cells roundish. The fruit stalk is lateral, [Plate IV., *5a*,] * the capsules erect and the lid conical, the fringe consisting of an outer and an inner row of sixteen teeth.

Woods will yield many of our most beautiful mosses, the borders where the shade is not too great being usually the most prolific spots. Many of the species already mentioned will be found, but the most characteristic are such mosses as *Mnium undulatum*, *Polytrichum formosum*, *Hypnum tamariscinum*, *H. triquetrum*, *Dicranum scoparium*, *Mnium hornum*, &c.

Mnium undulatum is a very noble-looking moss, not unfrequent in shady woods and on shady banks in a marly soil. It grows in large green patches, and has a very tree-like habit; the leaves are tongue-shaped, obtuse, with a slightly thickened margin, which is toothed with distinct simple teeth; towards the top of the stem the leaves form a rosette, and from this arise arched or pendulous whip-shaped branches. The leaves are undulated when moist, crisped when dry. The fruit, which is rare, is terminal, the fruit-stalks are long, and the capsules pendulous.

Mnium hornum, a denizen of like places, is far more frequent. This grows in dense green tufts, the stems being matted together with reddish rootlets. The leaves are lance-shaped, the margin thickened and

* All the references in this Article are to Plate IV., facing page 193.

bordered by a double row of teeth; fruit-stalk terminal and arched at the top like a swan's neck; capsule oblong, slightly drooping; lid convex, with a small point; in both these mosses the fringe is double, and forms a beautiful object for the microscope. Fruiting in May or June.

Polytrichum formosum rejoices in open woods, and forms extensive loose tufts. The stems are often five or six inches high, and are terminated by long fawn-coloured fruit-stalks. The capsules are large, four or five angled, and slightly swollen at the base, this swollen portion being called the apophysis, [Plate IV., Fig. 14 *c*.] The mouth of the capsule is closed by a reticulated diaphragm, (Fig. 21 *c*,) and fringed by sixty-four short, pale teeth. The lid is long and rostrate, (Fig. 13 *a*,) and the calyptra is clothed with numerous down-like hairs.

Hypnum triquetrum is frequent in many woods and on shady banks; grows in tall, rigid, shining tufts, several inches long, yellowish-green. The stems are red, and more or less branched. The stem leaves much recurved, clasping the stem at the base, thence gradually tapering to an acute point, minutely toothed on the margin, and striated or streaked on the surface; and with a lens two parallel veins will be seen, reaching more than half way up the leaf. The fruit-stalk proceeds from the side of the stem, bearing a short slightly curved capsule, with a conical lid. The fringe is double (Fig. 20, *a*, *b*.)

Hypnum tamariscinum is fond of like places, and occurs in loose, deep green tufts. This is one of the most beautiful of the feather mosses. The stem is tripinnate, and more or less clothed with numerous branched thread-like bodies (villi.) The leaves are heart-shaped, toothed on the margin, and covered on both surfaces with minute projections (papillæ.) This moss is often proliferous, *i.e.*, produces young plants from various parts of its surface. Hence the old name *H. proliferum*. The fruit is lateral and very rarely seen.

Dicranum scoparium is a beautiful moss occurring on marly banks and in woods, growing in yellowish tufts. The leaves are turned to one side and curved like a falchion, narrow lance-shaped, and sharply toothed. The nerve is well marked, and has several projecting ridges on the back. The fruit-stalk is terminal, the capsule curved, lid long and rostrate, (13*a*,) and the fringe consists of sixteen deep-red cloven teeth, beautifully marked with transverse bars. Fruiting in July.

[TO BE CONTINUED.]

FRESHWATER LIFE.—III. INFUSORIA.

BY EDWIN SMITH, M.A.

(Continued from page 292.)

Interesting as the sedentary Infusoria prove, the more closely they are studied, those kinds which swim about freely are even more striking on account of their varied and ceaseless movements. Let us next consider a few examples of this latter division.

Trachelius ovum, which I have taken from a lodgment of water in a meadow on New Year's Day, is from 1-50th to 1-80th of an inch long, or

ess. It is egg-shaped, and has the lip of its mouth prolonged on one side to form a flexible proboscis. The entire surface is banded with longitudinal rows of cilia, these organs being most distinct near the mouth. The general colour is faintly brown, becoming darker backwards. Near the hinder extremity I have noticed a relatively large spherical space, loosely occupied by a globular mass, containing a body of horse-shoe form, which I take to be the nucleus. Under pressure the globular mass was expelled, apparently by a definite passage edged with cilia. Though distorted in the process, the animal quickly resumed its normal shape, and, following the proboscis, turned continuously round its centre. Numerous small vacuoles are usually scattered through the interior. They disappear one by one for half a minute at a time, and then reappear. A constriction running lengthwise along the under-surface gives the body, viewed from behind, a kidney-like outline, the proboscis then curving towards the right. A digestive tract is plainly visible, extending with finely branching channels from the funnel-shaped mouth to what looks like a distinct anal orifice. Mr. Slack's drawing ("Marvels of Pond Life," p. 179) gives an accurate idea of the appearances presented.

Trachelocerca olor, the swan-neck animalcule, is always a pleasing object, as it sails smoothly and deliberately across the field, waving this side and that its long, lithe neck, sometimes backing water for a moment, or curling itself about some fragment of weed in quest of food. In length it may reach 1-40th of an inch ; but some specimens are much smaller. At the tip of the long neck is a short projecting disc, which marks the position of the mouth, and is armed with a tuft of fine cilia. Near the hinder extremity, which is more or less tapering, I have noticed a contractile space. Occasionally the neck appears forked, due, it has been supposed, to the commencement of fission. On the other hand, it is said that free-swimming Infusoria never multiply by longitudinal, only by transverse fission. The body has its surface prettily chequered, a feature which is still more distinct in an allied genus called *Lacrymaria*. My specimens of the latter were got in May, in a clay-pit, amongst Sphagnum.

Colpoda cucullus, common in stagnant water, has somewhat the shape of a bean narrowed in front. The cilia are strongest on the fore part, especially at the mouth, which is situated in a depression towards one side. Near the hinder end, which shows no signs of cilia, may be seen a contractile space. Entire minute diatoms are often found mingled with brown or reddish matter in the food vacuoles. The animal is of a rather soft consistence, and puts itself through contortions, during which the greenish granules lining the transparent envelope seem in constant flux. Should a portion of the body carrying cilia become accidentally detached, the fragment continues highly active like an independent being.

Paramecium, from a Greek word meaning *oblong*, comprises several species which approach more or less to an elliptical figure. Stein has made a special study of *P. bursaria*. His drawings show equal and similar cilia covering the entire surface, a distinct cortical layer beneath

the transparent envelope, two contractile spaces, a nucleus and nucleolus, short gullet, mouth, depression on the ventral side leading thereto, and chlorophyll granules diffused through the fluid contents of the interior. Transverse fission has been observed, when the nucleus separates into two, each half being accompanied by its nucleolus. At the same time contractile cavities form themselves in each segment into which the body divides. I have observed frequent instances of true conjugation of *Paramecia*, twice in the month of January. They pair by placing themselves side by side. But I have occasionally seen two individuals swim about for a long time grappled end to end, and then come apart without actual conjugation. The cilia were unusually active at the point of junction. In *Paramecium aurelia* two contractile vacuoles are seen, each branching out star-fashion into short canals, which appear distinct during the contraction of the central cavity, and are almost obliterated during dilatation. I have found this pretty species swarming in stagnant pools in spring.

Kerona, or *Stylonychia*, may be recognised by its slipper-like form, and the long spines and bristles with which it is furnished at both ends. In length it ranges from 1-275th to 1-100th of an inch. The body is also beset with smaller setæ, besides the active cilia by which it moves. A line of these organs leads to the mouth, which is fringed with them. The mouth itself is placed a little to one side, and is clearly indicated by the streams of floating particles which set towards the spot. In the rear of this opening is situated a contractile space, which dilates slowly but contracts suddenly, the whole movement taking about six seconds to complete. These animalcules have the queer habit of jerking back at short intervals, as they make their way through the water. Sometimes two individuals will fasten on to each other by their terminal spines, and swim about so connected for a considerable time. The two species answering to the above description are *K. mytilus* and *K. silurus*. Another common species, *K. polyporum*, is bean-shaped, filled with numerous vacuoles, and armed with several hooks, but not with the long spines or bristles of the preceding. It is parasitic on other freshwater animals.

Euplotes charon belongs to a family of Infusoria which are characterised by the possession of a lorica. The body, in fact, is encased above in a boat-shaped horny shield, ornamented with lines of prominent dots. The organs of locomotion are very highly developed. Cilia, bristles, and hooks make the little creature quite formidable, and enable it to swim, crawl or climb, back upwards or downwards, with the greatest agility. A contractile vesicle and a nucleus are present. *Euplotes* may be looked for amongst Algæ and other water-plants at all seasons.

Amphileptus resembles, both in form and movements, a small leech, having a highly extensible proboscis, or prolonged upper lip. The other extremity tapers to a tail. Rows of cilia are disposed lengthwise over the entire body; but these organs, as usual, are most conspicuous about the mouth. The interior is diversified by numerous food-vacuoles. One species, taken last June, seemed to me to be undergoing transverse self-division. I have generally found it amongst duck-weed.

Peridinium may be cited as a good example of the Flagellata. My specimens, got from a clay-pit in December, were of a rich Indian yellow hue, about 1-300th of an inch long, furnished with a belt of active cilia running round the middle, a minute mouth near the centre, and on one side of the mouth a lithe filament, the so-called flagellum. Provided with such ample means of locomotion, the little acrobats kept up their rolling and tumbling movements with untiring vigour. I watched them at all hours, and never caught them reposing. My belief is that they never once rested from birth to death.

I shall not add any remarks upon the *Tentaculifera*, about which competent opinions are as yet divided. All who are interested in the microscopic forms of Freshwater Life must hail with expectation Mr. Saville Kent's new book on the Infusoria, a work which, side by side with other well-known authorities, cannot fail to be of great assistance to the student.

HELIX CANTIANA, (Montagu.)

Since Martin Lister, in the latter part of the seventeenth century, indicated the existence of this Mollusk, which, he thought, might be a variety of *H. rufescens*, or a distinct species, giving as its habitat "Kent," an almost complete knowledge of the Mollusks inhabiting Britain has been attained, and it is of much interest to Conchologists to note the distribution of species over these Islands.

Montagu, in 1803, called it *Cantiana*, after its early recorded habitat. We know now that it occurs not only in the south and south-eastern counties, but has spread northward and westward, following the theoretical line of migration of the Mollusca of this country.

We have authentic records of its occurrence in twenty-one counties—twenty in England and one in Wales, as follows:—Sussex, Surrey, Kent, Middlesex, Hants, Somerset, Essex, Hertford, Oxford, Gloucester, Monmouth, Suffolk, Warwick, Worcester, Cambridge, Norfolk, Stafford, Lincoln, Yorkshire, Northumberland, and Glamorgan. This being the case, we should expect to find it in the central counties of Buckingham, Bedford, Huntingdon, Leicester, Northampton, Nottingham, and Derby; and southward in Berks, Wilts, and Dorset.

If any of our friends, while reading these notes, will take the map of England, they will readily see that, with three exceptions, the counties enumerated as habitats, are contiguous; and whether we ascribe its distribution to the creature's own powers of migration, or to man's agency, the result is the same; and we should scarcely expect that, in its spread, it would skirt the eastern coast from the south, and travel from south up the central counties, and miss those indicated.

It will be of much interest if any of our friends, having observed it in any of the counties named, would kindly inform us of the fact.

In our own district it occurs at Henley-in-Arden, where it was first observed by Mr. W. G. Blatch; and we have, during one of our pleasant

walks with that learned but modest Naturalist, Mr. Jas. Bagnall, seen it plentifully distributed along the canal bank at Holywell, about four miles from Henley. Mr. Slatter, of Redditch, says it is common at Littleton, near Evesham; and we have taken it near Evesham Railway Station. In all these places it extends for a considerable distance along the road. Nearly all the shells are rufous and white, white shells being uncommon; for, although Reeve says "the lower half of the shell is always tinged with a rufous foxy rust colour," it is not so; pure white shells are not uncommon in the south-eastern counties on the chalk, and occur occasionally wherever the species is plentiful.

The shells vary in size and texture, according to the nature of the creature's habitat; specimens from the chalk or limestone, where the plants upon which it feeds contain abundance of lime, are large and smooth, while those from the sparsely clad sand-dunes of Deal are stunted and rough. We have examples in our cabinet of a truly *minor* form, its dimensions are B. 0·55, Alt. 0·35, the ordinary size being B. 0·70, Alt. 0·40. We have shells B. 0·80, Alt. 0·50.

Dr. Turton says this species was introduced by "colliers" into Northumberland, where it occurs on the banks of the Tyne. In the "Quarterly Journal of Conchology" for August, 1878, our excellent correspondent, Mr. J. S. Gibbons, M.B., notes its occurrence on the Chalk Cliffs, near Flamborough Head, in Yorkshire, "in a locality so retired that it is impossible to suppose it otherwise than indigenous;" it is very common in some districts of central Yorkshire, and it is possible, therefore, that it may be found in Durham.

The locality, "near Dublin," is given in Gray's Turton, (p. 36,) probably on the authority of its being named as occurring there in Welsh and Whitelaw's History of Dublin; but Dr. J. Gwyn-Jeffreys says "subsequent writers on Irish Conchology have not confirmed the correctness of such statement."

Reeve says (p. 67) Mr. Guise believed it to have been introduced into Glamorganshire, where he found it between Swansea and Oystermouth.

We shall be very pleased to receive any further notes of the occurrence of this species in places not known to us.

G. Sherriff Tye.

Handsworth, Birmingham.

A PIECE OF CHALK.

BY FRED. F. GRENSTED, MAIDSTONE.

Only a piece of chalk, of no appreciable value, and yet it has preserved a decipherable record of marvellous events which happened numberless ages ago! Judging by analogy, where England now stands, water a mile or two in depth was "once upon a time" lashed into ocean waves by the passing wind. Travelling in thought to the bottom of this

unnamed sea of an unknown era we find the ocean floor covered with a white, soft, sticky mud, the exact counterpart of that which is found in the Atlantic at the present day. This mud would be almost entirely composed of very minute but lovely shells, which are now known by the generic name Foraminifera. They are so small as to require the aid of a good microscope to reveal their lovely forms. As in thought we gaze upon the scene with eyes enlightened by modern scientific research, we see these shells slowly falling through the water like a snowstorm, unceasingly day by day and year by year, as their tenants, once alive and swimming about in the water above, die off in countless myriads. Thus, generation after generation died and sank to the ocean bottom, and in turn was buried beneath the remains of its offspring. Thus, slowly but surely, fragment by fragment, were the chalk cliffs and downs of Albion deposited beneath the deep waters of a mighty sea.

All who may desire to be satisfied that this is no legend or fancy picture, have within easy reach the means of forming an independent judgment. They have merely to take a piece of chalk, or preferably some of the naturally formed powder found in chalk pits and on exposed cliffs, and ascertain of what it is composed. I will describe an easy and effectual method of doing this. If the natural powder is not within reach, any soft piece of chalk reduced to powder by being scraped with a knife will do almost equally well. Place some of the powder in an ordinary medicine bottle, fill up with clean water, and shake vigorously for some time. Then let the milky fluid settle for about ten minutes. Next, by means of a syphon, easily made with a piece of indiarubber tubing, draw off the contents of the bottle to within half an inch of the bottom. Fill up the bottle with fresh water, shake up as before, once more let the fluid settle, then draw off with the syphon to within the same distance of the bottom. Do this again and again until the fluid ceases to be milky, and becomes, as it were, diffused with fine dust, the separate grains of which will be plainly visible when the bottle is held close to the eye against a bright light. These grains are the treasures we are in search of. Besides them, however, the bottle will contain some small particles of chalk. To separate the one from the other is our next object, and it may be effected by shaking the bottle well, and instantaneously drawing off the fluid into another bottle by means of the syphon. This operation, if properly done, will remove the lighter shells and leave some of the heavier and the chalk behind. Having allowed the shells in the second bottle to subside, the water must be drawn off by the syphon. A good layer of these tiny shells may be obtained by repeating the process above described over and over again. The bulk of the water having been syphoned off, the shells should next be carefully filtered on blotting paper, then dried and stored in a pill box, or other convenient receptacle.

The shells thus obtained, if the operation has been properly done, should be perfectly clean, though fragments of shells will, of course, be found mixed with perfect ones. In the various stages of the process it is advisable to ascertain by means of the microscope that all is going on well. The method will be found very simple, and I can vouch for its success, for it has yielded me most satisfactory results.

To mount the specimens for the microscope all that remains to be done is to take as many as will lie on the point of a knife and boil them for a short time in a test tube containing a little turpentine. This is done to expel the air from the shells. Transfer a few of the specimens to the centre of a glass slip, add a spot of Canada balsam, and immediately place a thin cover glass on, and when dry finish off according to taste. The slides thus inexpensively provided will then be ready to answer the enquiry "What does the chalk contain?"

PARASITES OF MAN.*

BY T. SPENCER COBBOLD, M.D., F.R.S., ETC.

[*Continued from page 297.*]

The few nematoid parasites that remain to be considered comprise several rare and interesting species, and likewise two of the commonest intestinal worms. What I have incidentally advanced respecting the strange way in which the old writers confounded Guinea-worms with little serpents, finds noteworthy confirmation in the circumstance that the great strongyloid kidney-worm has also been looked upon as a species of venomous ophidian reptile. Facts of this order, if duly weighed, inevitably cause us to modify our interpretation of the statements made in ancient records. Thus, to return to the Guinea-worm. Whatever good the theosophical remedies recommended and enforced by Moses may have accomplished for the human victims suffering from the attacks of "fiery serpents," or Dracunculi, it is to be feared that no similar remedial measures of the mystical kind could be rendered available in the case of animals bitten by parasites that have been regarded as renal serpents. It is fortunate, indeed, for man that the great kidney-worm *(Eustrongylus gigas)* has only once been detected in the human body. If this formidable entozoon, capable of attaining a length of three feet, were as common in man as it is in certain animals, no doubt the superstitious people of southern climes would readily invoke clerical aid in view of obtaining miraculous cures. Possibly a mitigation of their sufferings might follow such exhibitions of human sympathy and trust. The case of animals, however, is very different. The unfortunate wolves of the Pyrenees cannot, of course, be expected to secure any very large amount of sympathy; nevertheless, it is the business and duty of the helminthologist to point to the causes of the sufferings of all kinds of animals, whether wild or domesticated, and so far as lies in his power to suggest the means whereby their sufferings may be mitigated. Not only do solitary and large nematoid parasites take up their abode in essentially vital organs of the body, and thus secure the slow destruction of the host, but the minutest forms of the same group

* Communicated by Mr. Hughes to the Microscopical Section of the Birmingham Natural History and Microscopical Society, November 19th, 1878. On Dr. Cobbold's behalf, Mr. Hughes exhibited a slide showing male and female examples of the destructive parasite *(Dochmius duodenalis)* which causes the Egyptian chloresis.

of entozoa frequently occur in sufficiently prodigious numbers to sweep off their victims by hundreds or even by thousands. Animal epizoötics due to this source have hitherto been little studied.

NEMATODA CONTINUED.

34.—*Eustrongylus gigas*, Diesing.

Synonymy.—*Strongylus gigas*, Rudolphi; *Ascaris renalis*, Gmelin; *Lumbricus in renibus*, Blasius; *Fusaria*, Zeder.

Larvæ.—The embryos are vermiform, and measure about the $\frac{1}{100}$ of an inch in length. In their higher larval state they have been recognised as filariæ (*F. cystica.*)

Intermediate Host.—From the anatomical observations of Schneider and Leuckart, it would seem that the immature worms dwell chiefly in freshwater fishes. Thus, the so-called *Filaria cystica* must be regarded as an immature *Eustrongylus gigas*. Hitherto, this little worm has been found occupying cysts or capsules, situated immediately beneath the peritoneal membrane in *Galaxias scriba*, and in certain oceanic fishes belonging to the genus *Synbranchus*. According to the eminent pisciologist, Müller, the *Galaxiidæ* present strong affinities to the *Salmonidæ*, but Cuvier considered them as essentially modified pikes (*Esocidæ.*)

Experiments.—Balbiani attempted to rear *Eustrongyli* by direct experiment. He administered the ova to dogs, but obtained only negative results. Similarly, his experiments on reptiles and fishes failed.

Remarks.—If the conclusions of Schneider and Leuckart be correct—and these make it appear that we must hold certain freshwater fishes as responsible media of infection—one can only express surprise that man is so seldom victimised by this parasite. The *Synbranchi*, being tropical fishes, can have little part in the infection of animals—apart from seals. One must suppose that pumas, dogs, wolves, gluttons, racoons, minks, weasels, and other carnivora contract this worm by attacking, capturing, and devouring fishes at times when they are prevented from obtaining other and more readily accessible kinds of food. How this parasite should in some instances gain access to herbivorous animals is not so clear.

Lit.—All standard works, and especially Leuckart's. One of the most remarkable memoirs quoted by Davaine is that of Clamorgan. In this old writer's work, "La Chasse de Loup," dated 1583, the kidney-worms, or Eustrongyli of modern writers, are characterised as "serpents and highly venomous beasts."

35.—*Strongylus bronchialis*, Cobbold.

Syn.—*Strongylus longevaginatus*, Diesing; *Filaria bronchialis*, Rudolphi; *Hamularia*, Treutler.

Larvæ.—Unknown.

Remarks.—This small viviparous entozoon, hitherto only twice encountered in the human body, is doubtless identical with *Strongylus longevaginatus*. The original specimen was discovered by Treutler in Germany, in 1791; the second being found by Dr. Jortsits, in Transylvania, many years afterwards (1845.) The males measure half an inch and the females rather more than an inch in length.

36.—*Dochmius duodenalis*, Leuckart.

Syn.—*Dochmius anchylostomum*, Molin; *Anchylostoma duodenale* Dubini; *Strongylus quadridentatus*, Von. Siebold; *Sclerostoma* Cobbold.

Larvæ.—Although the history of the development of the young worms has not actually been ascertained, it is tolerably certain that the structural characters they exhibit, and the changes they undergo, are similar to those of other closely allied species. Thus, without doubt, the free embryos are rhabditiform, and pass their larval lifetime in water, mud, and moist earth. After having undergone one or more changes of skin, attended with growth, they are possibly transferred to the human stomach.

Intermediate host.—It is not certain that any intermediary bearer is necessary.

Remarks.—Water drinkers in tropical climates readily become the victims of this parasite, either by swallowing the free swimming larvæ, or water insects containing the larvæ in a state of rest. The *Dochmius duodenalis* was discovered by Dubini, at Milan, in 1838, and its clinical importance in relation to the so-called Egyptian chlorosis was first announced by Griesinger. We now know that this destructive little parasite is a fertile cause of the wasting disorders of tropical countries generally; the affections termed *tropical anæmia* or *hypoæmia* being especially prevalent in the West Indies, in Cayenne, in Brazil, in Egypt, and in the Comoren Islands lying to the north-east of Madagascar. The worms are veritable bloodsuckers, behaving like leeches; probably, however, the loss of strength and diminution of vital power which they occasion is not so much due to the actual amount of blood abstracted as to the severe irritation resulting from the injuries they inflict upon the mucous membrane of the infested intestine.

Lit.—The Work of Leuckart; and especially a Memoir by Wucherer in Deutsches Archiv fur Klinische Medicin, Sept. 27, 1872, (s. 379—400.)

[TO BE CONTINUED.]

ON THE MICROSCOPICAL EXAMINATION OF CLAY.

BY THE REV. H. W. CROSSKEY, F.G.S.

A brief record of the results of considerable practical experience in the microscopical examination of clay may be of service to those engaged in the study of the drift beds of this district. As an illustration of what may be done by the employment of a good method, it may be mentioned that when the writer, in conjunction with his friend, Mr. D. Robertson, commenced to deal microscopically with the glacial clays, only two doubtful species of Ostracoda had been observed as fossils in them. We have succeeded, however, in cataloguing 136 species, of which 19 are either now extinct or unknown in the living state, and many are of extreme rarity.*

The first essential point is *thoroughly to dry the clay*. This ought to be slowly done. The clay should not be placed in an oven or close to a

* See Monograph on the Post Tertiary Entomostraca of Scotland, by G. S. Brady, Rev. H. W. Crosskey, and D. Robertson. Published by the Palæontographical Society, 1874.

hot fire, but gradually hardened. Anything like baking is apt to be destructive of delicate specimens. I have been accustomed to treat at one time enough clay to fill an ordinary pie-dish.

The clay, when thoroughly dry, should be placed in a large bowl of water, and allowed to remain undisturbed for a few hours. It should then be gently stirred up in the water, and it will be found to disintegrate in a remarkable way.

After the clay has been stirred up in the water, it should be allowed to settle quietly. If it is at all rich in organisms, a fine whitish scum will soon form upon the surface of the water, and must be carefully skimmed off. This *first scum* is the most valuable of all the treasures the clay can yield. It should be treated by itself, unmixed with baser matter, and placed upon a piece of the finest muslin to permit the water to drain away. A very simple and useful plan is to have a small hollow tin cylinder, and affix the muslin to one end by an elastic band. Through such a cylinder the skimmed water can readily be poured, and the muslin will retain the *debris* in which the organisms will be found. Muslin is preferable to a sieve, since a fresh piece can be used in dealing with the clay from each locality, and the possibility of any accidental accumulation of old material (such as may take place at the edges of a sieve) is prevented. The mesh should be as fine as will permit the drainage of the moisture. When the muslin, with its light burden, is dry, the contents may be placed upon a slate, and any organisms can be readily picked off.

The process described should be repeated until no scum will rise. It is possible that when a clay has failed to yield any more "floatings," after a second drying it may produce some. If the clay under examination be scarce, and a supply not readily obtainable, the water should be poured off as soon as all the "floatings" have been collected. The clay remaining at the bottom of the dish should again be dried, and the scum, if it chance to yield any, again collected. When all the "floatings" have been obtained, the clay itself should be washed. This is effected by pouring water upon it, stirring it, and then, after giving a few moments to permit the heavier material to fall, pouring off the water; and repeating the process until the fresh water is not at all mudded by the stirring of the material that is left. Abundance of water should be freely used; and generally a great many separate washings are required, but at last, if the clay has been really dry at the outset, the fine mud will disappear.

The remaining material will consist of grains of sand and pieces of gravel, together with such organisms as would not float; and must be dried for examination.

If the method described be carefully pursued, nothing ought to escape except the finely comminuted mud; and the observer ought to have every organism (the Diatomaceæ being of course excepted) preserved either in the "floatings" or the "washings."

Reviews.

The Herefordshire Pomona, containing coloured figures and descriptions of the most esteemed kinds of Apples and Pears. Edited by ROBERT HOGG, LL.D., F.L.S., &c. Issued by the Woolhope Naturalists' Field Club, Hereford. London: Hardwicke and Bogue. Part I., price 15s.

THE Woolhope Naturalists' Field Club is to be warmly congratulated on this sumptuous publication, by the preparation of which they have engaged in a work of national importance. The hardy fruits of the country are of vast economic value, while their importance as articles of food, and from a sanatory point of view, can scarcely be overstated. Of all the fruits which this country yields in abundance none are more deservedly appreciated than apples and pears. They may be profitably grown to a greater or less extent in nearly all parts of the British Islands; in many places they are successfully grown in enormous quantities. Apples and pears vary much in flavour and quality: some of the most esteemed are also the most prolific. To know which are the best kinds for any given locality and climate is manifestly important to all possessors of orchards or gardens. As knowledge on the subject becomes more general fewer mistakes will be made, and there is now no reason why a worthless or unsuitable variety should ever again be planted. "The Herefordshire Pomona" will spread sound knowledge on these and other points; and we trust this valuable publication will speedily become as widely known as its merits deserve.

To the labours, intelligent, unremitting, and beneficial, of the late Thomas Andrew Knight, a native of Herefordshire, and for years the President of the London Horticultural Society, may be traced what may not improperly be called the revival in recent times of hardy fruit cultivation. Dr. Bull (one of the most valuable members of the Woolhope Club) gives an interesting account of Mr. Knight's useful work in pages 29-38 of the work before us. He discusses at length the theory which Mr. Knight so thoroughly believed, that a graft can live no longer than the original tree from which it is taken. He plainly shows how incorrect it is. "The notion," he says, "seems to rest upon the assumption that the new wood which proceeds from the graft is not a new tree but only a detached part of the parent. But this is evidently a mistake. A branch produced by a graft is as distinctly a new and separate individual as a branch produced by a cutting. In both cases the bud is the source of new growth; and, physiologically speaking, a seed itself differs little from a bud, except in being more carefully protected, and in being spontaneously detached. The embryo in a seed, the bud inserted in budding, the buds in a graft or in a cutting, differ only in their position; and each, as it develops, becomes a new individual, not a mere dependent portion of the parent."* This unsound theory of Knight's led him to make experiments for the origination of new varieties of our hardy fruits worthy of general cultivation, with a view to restock our orchards and

* Any of our readers interested in this subject, and desirous of investigating it, will find an able and full discussion in Dr. Lindley's "Theory of Horticulture," chap. xvii., pp. 463-480, ed. 1855.

gardens with vigorous trees. And hence, however mistaken he was as to the duration of varieties, his labours were in the direction of the public good, and were most successful. Although previous to his time the uses of hybridisation were understood, Knight was one of the first to apply it in raising improved sorts of fruit trees. In Dr. Bull's sketch very full particulars are given of the work he did, and the success he achieved. It may to some seem a small matter now that he gave us better kinds of apples, cherries, nectarines, pears, plums, and strawberries, and some improved peas and other vegetables, for we are familiar with improved fruits and vegetables as things of constant introduction now-a-days, and we are apt to hold cheaply whatever comes easily. But it is a fact to be remembered that our present plentiful supply is due to the initial labours of Thomas Andrew Knight, and the example he set. Dr. Bull has then done a fitting thing in giving some details of the life history and work of one of Herefordshire's chief worthies in the "Herefordshire Pomona."

The plan of the book in reference to the fruits described is to tell the origin or history, and give a technical description of each fruit and its uses, with particulars as to the soils and situations in which it has been found to thrive. Each fruit is also depicted in a coloured drawing, and these illustrations must have been produced at great cost. They are some of the most successful instances of colour-printing we have seen. It is needless to add that while greatly adorning the work they add immensely to its practical value.

"The Herefordshire Pomona" is a work to be proud of, and everyone interested in the cultivation of apples and pears will feel bound to possess himself of a copy. The second part will be issued next year. Dr. Hogg, a well-known authority on Pomology, and an honorary member of the Woolhope Club, has kindly undertaken the arduous labour of editing the work. E. W. B.

West Yorkshire: An Account of its Geology, Physical Geography, Climatology, and Botany. Part I., Geology. By J. W. Davis, F.G.S., &c. Part II., Physical Geography and Botanical Topography. By J. W. Davis and F. Arnold Lees, F.L.S., M.R.C.S., &c. With maps and plates. London: L. Reeve and Co. 8vo., pp. 414. Price 21s.

Whilst comparatively few of us can adequately appreciate and thoroughly understand the minute descriptions of specific differences, and the elaborate articles on foreign Geology which form the more important records contained in the leading journals devoted to this science, it is with much pleasure that we take up a work devoted to the Geology and Botany of a district so near, and in many points so similar to our own as West Yorkshire. Nothing tends so much to show the value of local scientific societies as the publication of the results of the work of their members, especially when devoted, as is the goodly volume before us, to the elucidation of the physical phenomena peculiar to the several districts over which such societies claim special rights of investigation.

West Yorkshire is by no means a small area, for it contains 2,760 square miles; and it will therefore be seen that the examination of the Geology and Botany of so large a district is a very arduous undertaking.

In the work before us there is every evidence that on the part of each author this labour has been a work of love, and the perusal of the book will convince everyone that the work has been thoroughly and well done.

Commencing with a useful list of books written on the Geology of West Yorkshire, we have an introductory explanation of the chief physical features, main faults, and measures of the district, which is followed by a succession of chapters devoted to the several divisions of rocks—from the Silurian to the Post-tertiary—represented in the locality. The county, as a whole, furnishes a most comprehensive field for geological study, for the author says, "If the whole of the county be taken, we have all the great divisions well represented, except . . the Cambrian and Laurentian, thus presenting in so small an area a more glorious epitome of the strata comprising the earth's crust than can be found in any other locality of similar, or even much larger extent in the world."

The Silurian beds are the Coniston Limestone, with the superincumbent Flags and Grits and the Bannisdale Slates, which altogether attain a great thickness, and represent the beds above and below the line of division of the Lower and Upper Silurian beds, as laid down by Sedgwick, who devoted a great deal of time and attention to the examination of the Coniston Rocks. The occurrence of a bed of sandstone 20 feet thick, with fossils of the Ludlow type, at so great a depth (1,200 feet) below the Ludlow beds, is an interesting and remarkable circumstance.

The succeeding period of Sedimentary Rocks (the Devonian) is but imperfectly represented in West Yorkshire. At page 41 the author gives an interesting account of what was going on between the deposition of the Silurian beds and that of the Carboniferous Limestone.

The Carboniferous Rocks, consisting of the Mountain Limestone, Yoredale Beds, Millstone Grit, and Coal Measures, seem all to be peculiarly well developed in this district, and they are very particularly described, with the faults, &c. The numerous sections and long lists of fossils show how accurately these beds have been investigated, and, apparently, they offer a very wide field for examination. The purity of some of the coals of the district is of great economical importance, among which we may especially mention the Better Bed Coal, of which the author says (p. 143:)—"It is extensively worked in the Lowmoor district, for the purpose of smelting the iron ore found in the shale above the Black Bed Coal. Its freedom from sulphur and other impurities renders it peculiarly valuable for smelting purposes; and it is partially to this coal that the excellence of the Lowmoor iron is attributed." We believe it was this bed of coal which Professor Huxley described as being entirely composed of lycopod spores, to which, probably, it owes its great purity. We notice our author does not give us any lists of fossil coal plants, the study of which seems unfortunately to have an attraction for only very few of our Botanists. The Permian rocks of the district seem to be more developed than in our own district, but we notice the absence of the several sub-divisions of the Bunter beds which are found in the Midlands.

There is an interesting chapter devoted to the Glacial and Post-glacial deposits, together with a brief account of the exploration of the Settle and other caves.

The second part of the work commences with an outline of the physical geography of West Yorkshire, and is followed by an examination of the flora of the ten divisions into which the district is sub-divided, according to river drainage. This is accompanied by a good map, from which can be seen at a glance the several districts treated of in the successive chapters. The flora is an extremely rich one, for the author

says (p. 242) it "is almost more than any other equal area not possessing the advantage of a long varied coast-line could produce, and the causes are not far to seek. The possession of a tidal river-board giving it some maritime plants, its extent and diversity of surface ranging from near sea level to 2,400 feet, from fen and warren to elevated peat-bogs and Alpine rocks, and the wide variation in its climate consequent upon these, are all factors in the sum of its flora." The various influences affecting the distribution of plants are described in an interesting manner, and a comparison is made with the flora of neighbouring counties, together with lists, &c., of plants of Atlantic and Germanic types. For the manner in which the Botany of the district has been worked out we must refer our readers to the work itself, adding that the lists of plants are so carefully reported under the several localities as to give most satisfactory evidence of the pains taken to make this information as complete as possible.

In the preface the authors say that "The Climatology, the 'Flora' proper, and their connections are reserved for a second volume," which we understand will be published next month, thus completing a record of investigation and research most creditable to the authors, and one which cannot fail to be extremely useful. W. MADELEY.

CORRECTION.—Report of the Burton-upon-Trent Natural History and Archæological Society.—In the notice of this publication (ante p. 305) a mistake is made by attributing the authorship of the paper on "The History of Burton Abbey" to the Rev. C. F. Thornewill. The paper was written by Mr. Robert Thornewill.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF OCTOBER, 1878.

BY W. JEROME HARRISON, F.G.S.

Most of our observers agree in describing the weather as fairly fine and dry up to the 20th, but wet and stormy after that date to the end of the month. Whilst the rainfall was about the average, temperature was decidedly higher. The pressure of air, as indicated by the barometer, was very variable, a fact due to the rapid succession of depressions and anticyclones passing over our Islands from the south-west to the north-east.

Thunderstorms are reported from Stroud on the 9th, Buxton on 28th and 30th, Weston-under-Lyziard on the 29th, Leicestershire 25th, Brampton St. Thomas on 28th, Spondon 28th to 30th.

Snow fell very generally on the 29th and 30th, but melted very soon; at Uppingham it was four inches in depth. Hail-storms were also frequent on the last three days of the month.

There was little or no frost till the very end of October, and, as a consequence of the mildness of the weather, many migratory birds delayed their departure, while flowers continued to bloom freely. Swallows appeared again at Stroud on the 16th; three were seen at Tamworth on the 15th. At Worksop these birds were seen as late as the 26th. The fieldfare arrived at Tamworth on the 16th; redwings and woodcocks were seen near Bishop's Castle on the same day. At Waltham bees were in full work on ivy and chrysanthemum till 22nd, and at Shifnal the red admiral and tortoiseshell butterflies were out till the 19th, when also a large dragon fly was seen hawking for flies, as in the height of summer. Primroses were gathered near Melton Mowbray on the 19th.

STATION.	OBSERVER.	RAINFALL. Total for M. In.	Greatest fall in 24 hours. In.	Greatest fall in 24 hours. Date.	No. of rainy d	TEMPERATURE. Greatest ht. Deg	Greatest ht. Date.	Great'st cold. Deg	Great'st cold. Date.
GLOUCESTERSHIRE.									
Cainscross, Stroud	W. B. Baker, Esq.	4·48	·75	31		70·0	7	30·0	31
Cheltenham	R. Tyrer, Esq.	3·39	·67	31	19	71·5	5	27·4	30
Stroud	S. J. Coley, Esq.	3·86	·85	24	15	68·0	7	34·0	29, 30, 31
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	3·70	·59	9	17	65·0	5 & 6	30·0	31
Whitchurch	A. B. George, Esq.	3·91	·55	9	19				
Woolstaston	Rev. E. D. Carr	6·28	·94	9	22	66·0	5	29·5	30
Leaton Vicarage, Shrewsbury	Rev. E. V. Pigott	4·30	·60	6	21	66·0	6	29·8	31
More Rectory, Bishop's Castle	Rev. A. Male	5·48	·90	9	21	68·0	5	19·0	30
Larden Hall, Much Wenlock	Miss F. R. Boughton	4·93	·84	9	20				
Bishop's Castle	E. Griffiths, Esq.	4·59	·91	9	22	67·0	5 & 6	30·0	30
Cardington	Rev. Wm. Elliott	5·33	·92	9	23				
Adderley Rectory	Rev. A. Corbet	3·27	·55	21	24				
Stokesay	Rev. J. D. La Touche	4·38	1·08	9	19	69·1	5	22·2	30
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	4·69	1·06	9	20			26·0	30
Stoke Bliss	Rev. G. E. Alexander	4·21	·70	9	20	68·0	5	31·0	29
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq	4·26	·70	9	22	71·2	5	30·5	31
West Malvern	A. H. Hartland, Esq.	4·64	·77	23	22	72·0	5	29·[illegible]	29
Pedmore	E. B. Marten, Esq.	4·42	·79	9	19	68·0	5	30·0	29, 30, 31
Stourbridge	Mr. J. Jeffries	4·01	·67	9	17	70·0	5 & 6	28·0	30 & 31
St. John's, Worcester	G. B. Wetheral, Esq.	3·60	·60	23	18	66·0	6	30·0	31
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	3·20	·50	9	21				
Barlaston	W. Scott, Esq.	3·64	·58	21	18	68·8	5	23·6	19
Amblecote	Mr. J. Robins	3·59	·59	9	17				
Dudley	Mr. J. Fisher	3·24	·46	9	20	70·0	6	30·0	29
Sedgley	Mr. C. Beale	2·97	·54	9	21	65·0	5	32·0	31
Kinver	Rev. W. H. Bolton	4·47	·78	19	21	66·0	5 & 6	30·0	29 & 30
Walsall	Mr. N. E. Best	3·14	·58	9	19	68·0	5	32·0	29 & 31
Grammar School, Burton	C. U. Tripp, Esq.	2·90	·54	24	20	73·0	5	[illegible]0·0	30
Patshull Gardens	Mr. T. W. Dell	3·10	·55	10	15	[illegible]4·0	6	28·0	31
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	3·65	·61	21	25	68·5	6	31·5	31
Wrottesley	E. Simpson, Esq.	3·10	·55	9	15	68·5	6	29·4	30
Tamworth	W. Arnold, Esq.	3·01	·67	24	19				
Tean Vicarage, near Cheadle	Rev. G. T. Ryves	3·71			21	6[illegible]·2	6	28·0	30
Heath House, Cheadle	J. G. Philips, Esq.	3·35	·54	25	18	67·0	5	29·0	30
Alstonfield Vicarage	Rev. W. H. Purchas	4·19	·73	25	15	64·6	5	24·5	29
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	2·98	·5[illegible]	23	22	[illegible]6·0	5	33·0	29 & 30
Coventry	J. Gulson, Esq.	2·59	·49	23	20	66·0		32·0	30 & 31
Bickenhill Vicarage	J. Ward, Esq.	3·[illegible]7	·59	23	21	72·0		28·0	
St. Mary's College, Oscott	Rev. S. J. Whitty	3·17	·47	21	20	71·6	5	30·8	30
Henley-in-Arden	T. H. G. Newton, Esq.	3·46	·59	24	20	74·0	5	30·0	31
Rugby School	Rev. T. N. Hutchinson	2·64	·59	21	16	73·0	5	30·0	30
DERBYSHIRE.									
Buxton	E. J. Sykes, Esq.	6·32	·91	10	20	67·8	5	27·0	2 & 29
Stoney Middleton	Rev. U. Smith	4·09	·84	24	14	64·0	5, 6, 7	30.0	29
Brampton St. Thomas	Rev. J. M. Mello	3·49	·90	24	13	70·0	5	29·0	3 & 30
Fernslope, Belper	J. G. Jackson, Esq.	3·54	·53	21	21	68·0	5	29·0	30
Linacre Reservoir, Ches'field	C. E. Jones, Esq.	3·84	·66	9	19				
Willesley Gardens, Cromford.	J. Tissington, Esq.	3·71			15				
Spondon	J. T. Barber, Esq.	2·48	·72	24	15			29·0	27
YORKSHIRE.									
Hesley Hall	B. J. Whitaker, Esq.	2·32	·36	26	18	71·0	6	32·0	31
NOTTINGHAMSHIRE.									
Highfield House, Nottingh'm	E. J. Lowe, Esq.	3·07	·70	21		73·6	5	26·7	30
Hodsock Priory, Worksop	H. Mellish, Esq.	2·50	·66	24	19	70·5	5	27·0	30
Park Hill, Nottingham	H. F. Johnson, Esq.	3·21	·74	24	18	68·5	5	31·5	
LEICESTERSHIRE.									29
Loughborough	W. Berridge, Esq.	2·46	·55	24	20	74·7	5	29·5	
Ashby Magna	Rev. E. Willes	2·54	·70	24	21	68·0	5	32·0	27
Market Harborough	S. W. Cox, Esq.	2·53	·50	21	17	68·0	5	27·0	30 & 31
Kibworth	T. Macauley, Esq.	2·64	·48	23	19				29
Town Museum, Leicester	W. J. Harrison, Esq.	2·57	·40	24	[illegible]0	71·9	5	31·2	29 & 30
Belmont Villas, Leicester	H. Billson, Esq.	2·51	·43	23	20	70·8	5	30·0	30
Syston	J. Haines, jun., Esq.	2·52	·80	24	18	72·0	6	29·0	31
Waltham-le-Wold	E. Ball, Esq.	2·58	·54	24	16	67·0	5	28·0	19
Little Dalby Hall	G. Jones, Esq.	2·50	·44	29	17	70·0	5	26·0	30
Coston Rectory, Melton	Rev. A. M. Rendell	2·36	·56	24	17	69·[illegible]	5	25·0	30
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	2·[illegible]3	·47	21 & 23	12	68·0			
Castle Ashby	R. G. Scriven, Esq.	2·32	·50	24	16	74·0	5	33·0	29
Pitsford	C. A. Markham, Esq.	2·32	·50	22	21	67·0	6	30·0	30
Kettering	J. Wallis, Esq.	2·61	·58	24	20	66·0	7	30·0	30
Althorpe	W. F. Jakeman, Esq.	2·50	·55	23	14	68·0	5 & 6	30.0	29 & 30
Northampton	H. Terry, Esq.	2·26	·44	9	14		5	31·0	29
RUTLAND.									
Burley-on-the-Hill	W. Temple, Esq.	2·57	·71	26	20	6[illegible]·0	3	25·0	30
West Deyne, Uppingham	Rev. G. H. Mullins	2·4[illegible]	·50	29	20	70·8	5	29·0	30
Northfields, Stamford	W. Hayes, Esq.	2·27	·40	24	16	70·0	7	32·0	20
Radcliffe Observatory, Oxford	Mr. H. E. Bellamy	3.11	1·03	19	15	70·0	5	32·1	30
Spital Cemetery, Carlisle	T. Bell, Esq.	3.19	·75	21	17	70·7	5	25·2	31
Ventnor Hospital	H. Sagar, Esq.	3.01	·75	25	13	73·8	5	34·2	30
Altarnun Vicarage	Rev. G. Tripp	3.63	1·33	23	19	71·0	6	34·0	18

Microscopy.

A paper read by Mr. Thomas Bolton at a recent meeting of the Birmingham Natural History Society, "On the Examination of Rotifers and Infusoria under the Microscope," suggests a remark or two which may be useful as hints to some of our readers.

Most forms of compressorium are useless, all are expensive. Those who try the following will be surprised at the efficiency of the apparatus. Two pieces of thin glass are cemented on to a glass slip in the shape of the letter L, but with the two strokes of the letter about equal in length, and another thinner and longer one is fixed longitudinally, thus L—— The L serves to retain in position a square slip of cover glass placed, of course, not on the L but inside it; the horizontal piece, which should be ground to a bevel on its top edge before fixing it, serves to carry a fine needle, the point of which is inserted beneath the edge of the cover glass. This point being tapered, it is easy to increase or diminish the thickness of a film of water carried between the cover and the slip by pushing the needle further in or out, and so to form a cheap and effective compressorium.

Those who possess a Ross's four-tenths condenser will find the arrangement of stops marked O over B give the most perfect dark background illumination. available, by unscrewing the top lens of the combination, for low powers.

The beauty of Rotifers and Infusoria seen by this illumination is immensely enhanced by feeding them with carmine, sparingly supplied to the water by drawing a camel-hair brush, charged with some of the pigment, along its surface. In a few minutes the stomachs of Rotifers and the cavities of Infusoria are painted with the most glowing colour, while the ciliary currents to and from the animals are traced out in equally brilliant lines.

The cases of all the thecated Rotifers are tinged with the colour upon which their tenants are fed. Hence evidently the material out of which they are constructed is a product elaborated from the food of the animal.

Microscopists will be glad to hear of a really good low priced revolving microscope table, which is accurately described in the maker's advertisement as "steady and substantial." The legs, which form a tripod, are handsomely cast in iron and bronzed; the top is made of a thick slab of slate. Without being inconveniently large it is large enough for all practical purposes. The microscope and lamp may be readily adjusted at one side of it, and then quietly moved round without readjustment to other students sitting round the table. There is room on the table for a compound microscope and lamp, a simple or dissecting microscope for preparing objects for the larger one, or for biological laboratory work, and for note-book and text-book, or other writing materials, either of which may be successively brought round to the student as it may be required, by the mere revolution of the table. The top being made of slate is very serviceable and easily cleaned. An ornamental cover over the slate top when the table is not in use for microscopical work will make it fit for a place in the drawing room. The table is also made with a solid mahogany top, the centre of which is inlaid with leather to meet the wishes of those who prefer a wood to a slate top. The manufacturers are Messrs. Hassall and Singleton, ironfounders, Birmingham, who have arranged with Mr. T. Bolton, 17, Ann Street, Birmingham to supply retail customers.

Correspondence.

Scientific Names.—With reference to Dr. Cobbold's appeal to me in the November number of the "Midland Naturalist," (p. 295,) it may be observed that we have the authority of the Greeks themselves for a departure from the usual plan in the formation of the words Distomum and Tristomum, these actual words, (with others of a like character,) occurring, of course in their Greek form, in that language. But these exceptions do not invalidate the general rule, which is as I have stated it, and it would be hard to say that we must not use such a word as Polystoma, while *polupous*, *polucheir*, &c., are good Greek. Another observation is that when Distomum is used, Distomidæ becomes correct; the error consists in using Distoma and Distomidæ concurrently. No one can say that it is unfitting to employ "complimentary" generic names, many of them, as Linnæa and Lobelia, being among the prettiest we have, and even Lyellii and Forsteri may be tolerated. But every one, who is not a professional nomenclator, regrets that the liberty is so often abused: the "compliment" has now become so common, that one scarcely cares to enquire, or even to wonder, who the *savant* is, who is supposed to be complimented.—W. B. Grove.

Fungi.—I should be much obliged if some of the readers of the "Midland Naturalist" would kindly inform me whether they have found the Chantarelle in Leicestershire. I have failed so far, though this locality is a fairly good one. I have found it in Warwickshire. Few people, I think, are aware how very good eating some of the quite common fungi are. *Hygrophorus virgineus* and *H. pratensis*, *Boletus edulis*, and the Maned Agaric are among the best. I have almost invariably found *B. edulis* under oak trees. Is this the usual experience? One other circumstance I should like to have corroborated, and, if it may be, explained. This autumn we buried, about 5ft. deep, a quantity of diseased potatos. About a fortnight ago I observed quite a large crop of *Peziza aurantia* growing over the spot, though I had never before observed it in the garden or its immediate neighbourhood. Was this merely a coincidence?—E. A. Green, Normanton Rectory, Ashby-de-la-Zouch.

Miller's Dale Flora.—I was rather surprised to notice Mr. G. Robson (an old correspondent of mine) recording the botany of Miller's Dale as "rather disappointing." Its botany pleased me as much as the perusal of Mr. Robson's really fine description of a Derbyshire thunder-storm. In addition to the ferns he mentions I have found many other uncommon plants within about half an hour's walk from the station, such as:—*Thalictrum flavum*, *Trollius europæus*, *Helleborus viridis*, *Draba incana*, *Silene nutans*, *Hypericum montanum*, *Geranium sanguineum*, *G. pratense*, *G. columbinum*, *Rhamnus catharticus*, *Prunus Padus*, *Sanguisorba officinalis*, *Poterium Sanguisorba*, *Potentilla verna*, *Rubus cæsius*, *R. saxatilis*, *Geum intermedium*, *Rosa tomentosa*, *R. arvensis*, *Pyrus Aria*, *P. rupicola*, *Ribes Grossularia*, *R. alpinum*, *R. rubrum*, *Sedum Telephium*, *Saxifraga granulata*, *S. hypnoides*, *Parnassia palustris*, *Pimpinella magna*, *Cornus sanguinea*, *Galium sylvestre*, *Scabiosa Columbaria*, *Carduus nutans*, *C. crispus*, *C. heterophyllus*, *Carlina vulgaris*, *Serratula tinctoria*, *Lactuca muralis*, *Campanula Trachelium*, *C. latifolia*, *Ligustrum vulgare*, (not in or near hedges,) *Gentiana Amarella*, *Calamintha Acinos*, *Myosotis collina*, *Polygonum Bistorta*, *Taxus baccata*, *Blysmus compressus*, *Phleum nodosum*, *Avena pubescens*, *Kœleria cristata*, *Melica nutans*, *Poa nemoralis*, *Aspidium lobatum*, *Botrychium Lunaria*, and many other good plants. I have found a few miles further up Chee Dale, towards Buxton, *Hutchinsia petræa*, *Cardamine impatiens*, *Polemonium cæruleum*, *Draba muralis*, *Mimulus luteus*, &c. I have only paid flying visits to the neighbourhood alone, and therefore do not pretend to know all the rare plants.—Wm. West, Bradford.

A Hybrid Fern.—In the February number of "The Midland Naturalist," (p. 52,) an account was given of a supposed hybrid fern, which had produced spores. These spores, after being sown, appeared to produce prothallia, but it has since turned out that the latter had sprung from other spores accidentally introduced, as often happens to fern-growers.—W. B. G.

Signs of Early Winter.—A flock of fieldfares, (*Turdus pilaris,*) the first I saw this season, numbering about twenty, flew over Handsworth Parish Church about nine o'clock on Tuesday morning, 28th October last. The temperature fell during the day, and in the evening, at half-past nine o'clock, there was a heavy snow storm.—W. R. H., Handsworth Wood, 21st November, 1878.

Gleanings.

The British Association.—The meeting at Sheffield next year will begin on August 20th, and not on the earlier day previously announced.

"The Art of Scientific Discovery" is the title of an important new book (648 pp.) by Mr. G. Gore, LL.D., F.R.S., of Birmingham, just published by Messrs. Longmans and Co.

The Sphagnaceæ, or Peat Mosses of Europe and North America, by Dr. Braithwaite, an octavo volume, illustrated with twenty-nine plates, is announced by Messrs. Hardwicke and Bogue.

Mr. Charles R. Thatcher, the well-known conchological collector, started a few months ago on an extended foreign collecting tour. He was attacked suddenly by fever, and died a few days after his arrival at Shanghai.

The Rev. M. J. Berkeley, M.A., F.L.S.—A portrait of this eminent fungologist, painted by Mr. Peele, at the instance of a number of Mr. Berkeley's friends, was recently presented on their behalf to the Linnean Society by Sir Joseph Hooker.

Do Leaves absorb Water?—The Rev. Geo. Henslow read a paper on this subject at the Linnean Society on the 7th November, in which he replied to the question affirmatively, and detailed the experiments he had made. He pointed out that the practical issue of what he proved is that syringing is not merely beneficial to plants in that it cleanses them and cools the air about them, but that the water is actually absorbed by the leaves.

The Royal Society Medals for the present year have been awarded as under:—The Copley Medal to M. Jean Baptiste Boussingault, for his long-continued and important researches and discoveries in Agricultural Chemistry; a Royal Medal to Mr. John Allan Broun, F.R.S., for his investigations in Magnetism and Meteorology, and for his improvements in methods of observation; a Royal Medal to Dr. Albert Günther, F.R.S., for his contribution to the Zoology and Anatomy of Fishes and Reptiles; the Rumford Medal to M. Alfred Cornu, for various optical researches, and especially for his recent re-determination of the velocity of propagation of light; and the Davy Medal to MM. Louis Paul Cailletet and Raoul Pictet, for their researches, conducted independently but contemporaneously, on the condensation of the so-called permanent gases.

HYBRIDISATION.—From the "Herefordshire Pomona" we glean the following interesting facts as to the results of some of the fertilisation experiments made by Thos. Andrew Knight. From pips or seeds of the Orange pippin apple fertilised by pollen of the Golden pippin he obtained the Grange pippin (1802,) Downton pippin (1804,) Red Ingestrie (1800,) and Yellow Ingestrie (1800.) The two last-named apples were not only derived from the same parentage, but actually sprang from two pips which occupied the same cell in the same apple. From pips of the Siberian crab, fertilised by pollen from the Orange pippin, were produced the Yellow Siberian (1805,) the Siberian pippin (1806,) and the Foxley apple (1808.)

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—GEOLOGICAL SECTION.—October 22nd. Some specimens of rocks from Malvern, sent by the Rev. W. S. Symonds were exhibited, and the thanks of the section were ordered to be sent to that gentleman. The section determined to take part in the scheme for the united examination of the glacial deposits of the midland counties, as proposed by Mr. W. J. Harrison, and appointed the Rev. H. W. Crosskey as secretary of the committee, to whom all communications may be addressed. Mr. C. J. Watson exhibited specimens from the carboniferous limestone of Yorkshire. Mr. Wilkinson showed some beautiful fungi from Malvern. Mr. T. H. Waller read some notes on specimens of rocks from Shetland and Orkney, and showed specimens and microscopic sections of them.—GENERAL MEETING.—November 5th. Mr. Montagu Browne exhibited two beautiful butterflies (*Morpho Cypris*) from Brazil. Mr. J. Bagnall exhibited microscopic slides, illustrating free cell formation and cell formation by merismatic division of protoplasm; he also exhibited one of the Hepaticæ, *Riccia glauca*, new to the district; *Mnium cuspidatum*, in fruit, from Sutton Park; and a number of rare plants, amongst which were the following: *Euphorbia Peplis*, *Corrigiola littoralis*, *Frankenia lævis*, *Lysimachia thyrsiflora*, *Ophioglossum ambiguum*, &c. Six beautiful slides were exhibited and presented to the society, together with a full description of the way in which they had been mounted, from Mr. F. W. Sharpus, of London. They consisted of the following: *Bugula flabellata*, *B. plumosa*, *Vanessa Urticæ*, Pedicellariæ of *Uraster glacialis*, *Bombyx mori*, and Palate of *Buccinum*. A cordial vote of thanks was passed to Mr. Sharpus.—BIOLOGICAL SECTION.—November 12th. Mr. J. E. Bagnall read "Notes on Plants Collected this Season," with special reference to their distribution—first, in Warwickshire; second, in Great Britain; and third, over the general surface of the globe. He also reviewed the several hypotheses which have been advanced to account for plant-distribution, summarising the theories proposed respectively by Linnæus, E. Forbes, Hooker, and Darwin. The paper was illustrated by a large and beautifully mounted collection of rare plants, collected during the past season in new Warwickshire stations, such as *Potamogeton zosterifolius*, *Vicia gracilis*, *Agrimonia odorata*, *Centunculus minimus*, and many others of equal rarity. Mr. T. Bolton gave "Notes on the Examination of Rotifers and Infusoria under the Microscope," in which he dealt with the manipulations necessary in isolating and observing the motile and fixed forms of these organisms severally, the use of various kinds of live-troughs, compressoria, and other contrivances for facilitating their investigation under the microscope, &c., illustrating his remarks by the selection and exhibition of a variety of such animals, *e. g.*, *Stephanoceros Eichhornii*, *Stentor Mülleri*, *Limnias ceratophylli*, *Vorticellæ*, *Philodina roseola*, &c., &c. Both the papers of the evening elicited considerable discussion.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY.—October 30th. Mr. J. Levick read a paper on Microscopical Apparatus. In the course of it the purchase of cheap binocular instruments was deprecated, as they generally proved unsatisfactory, so that unless a considerable outlay could be made it was better to buy a monocular. One common source of mischief was

pointed out, namely, that the two eyepieces, although meant for a pair, are frequently of different focal power, and thus produce images of different sizes; so that the eyes in trying to combine these two images suffer more harm than from a monocular. The paraboloid and other adjuncts were described, and their uses illustrated.—November 13th. Mr. A. Cresswell described a new method of Automatic Railway Signalling invented by himself. In this method, which is worked entirely by electricity, there is required a metallic conductor electrically insulated, running along the whole length of the railway, with which, by means of a metallic brush or friction wheel, the engine makes connection. This conductor is divided into sections of convenient length—such as a mile—and wires connect each of these segments with the automatic signalling instrument at the nearest convenient station. When a current passes through a segment and the engine on it, an all-right signal is exhibited on the engine to the driver; but the action of the current passing is also by means of an electro-magnet in the station instrument made to break the electrical circuit in the segment behind the train; and, therefore, on an engine entering this segment, its indicator will fly to danger. The breakage of a conductor or failure of a battery will also put the indicator to danger, and thus, though it may delay the train, will render a collision impossible. The position of any train on the line can at any time be ascertained by simply inspecting the station instrument, although the instrument itself requires no one to attend to it. The details were fully explained by Mr. Cresswell, by the aid of a working diagram; and he also promised that a working model should shortly be exhibited to the public.

BURTON NATURAL HISTORY AND ARCHÆOLOGICAL SOCIETY. —The Winter Session was opened on the 22nd October by a Conversazione, which was held at St. George's Hall. There was a large number of exhibits, biological, geological, archæological, and scientific. A very pleasant evening was spent, to which the singing of the Burton Glee Club agreeably contributed.

EVESHAM FIELD NATURALISTS' CLUB.--The Annual Meeting was held on the 30th October, the Rev. J. C. Odgers in the chair. The Hon. Secretary (Mr. G. New) read the annual report, by which it appears the number of members has decreased to twenty-eight, compared with thirty-two last year. During the past season there were excursions to Tiddesley Wood, Dovedale, Buckland Woods, the Abbey Manor Grounds, and to Worcester Natural History Museum. The evening meetings were held once a month throughout the winter. The financial position of the Club is reported to be satisfactory. Mr. John Gibbs was re-elected president, and Mr. J. S. Slater treasurer. Mr. E. B. Martin was elected hon. secretary, and a vote of thanks was accorded to Mr. Geoffrey New for his services during the past two years. The Rev. J. C. Odgers, Mrs. Martin, and Messrs. A. H. Martin and T. E. Doeg were elected to form the committee. On the secretary reporting the receipt of papers from the Hon. Secretary of the Midland Union of Natural History Societies on the subject of the examination of the glacial deposits of the Midland Counties, he was instructed to send a copy to Mr. Winnington Ingram and Mr. Gibbs, with a request that Mr. Ingram would represent the club.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.— NATURAL SCIENCE SECTION.—October 18th. Mr. A. Bush read a paper on the "Morphology and Physiology of a Freshwater Mussel." November 8th.—Mr. E. Smith, M.A., read a paper on "Infusoria," illustrated by photographic and other lantern slides. This paper is printed in the "Midland Naturalist" for November and December. November 15th.—Microscopical meeting; subject: "Fresh-water Life."

NOTTINGHAM NATURALISTS' SOCIETY.—The following meetings have been held:—October 16, Lecture on Coal, by C. T. Musson; November 6, Lecture on the Phonograph, by Mr. A. H. Simpson; November 13, Special General Meeting, at which "The position of the Society with regard to other Nottingham Societies" was the subject of discussion.

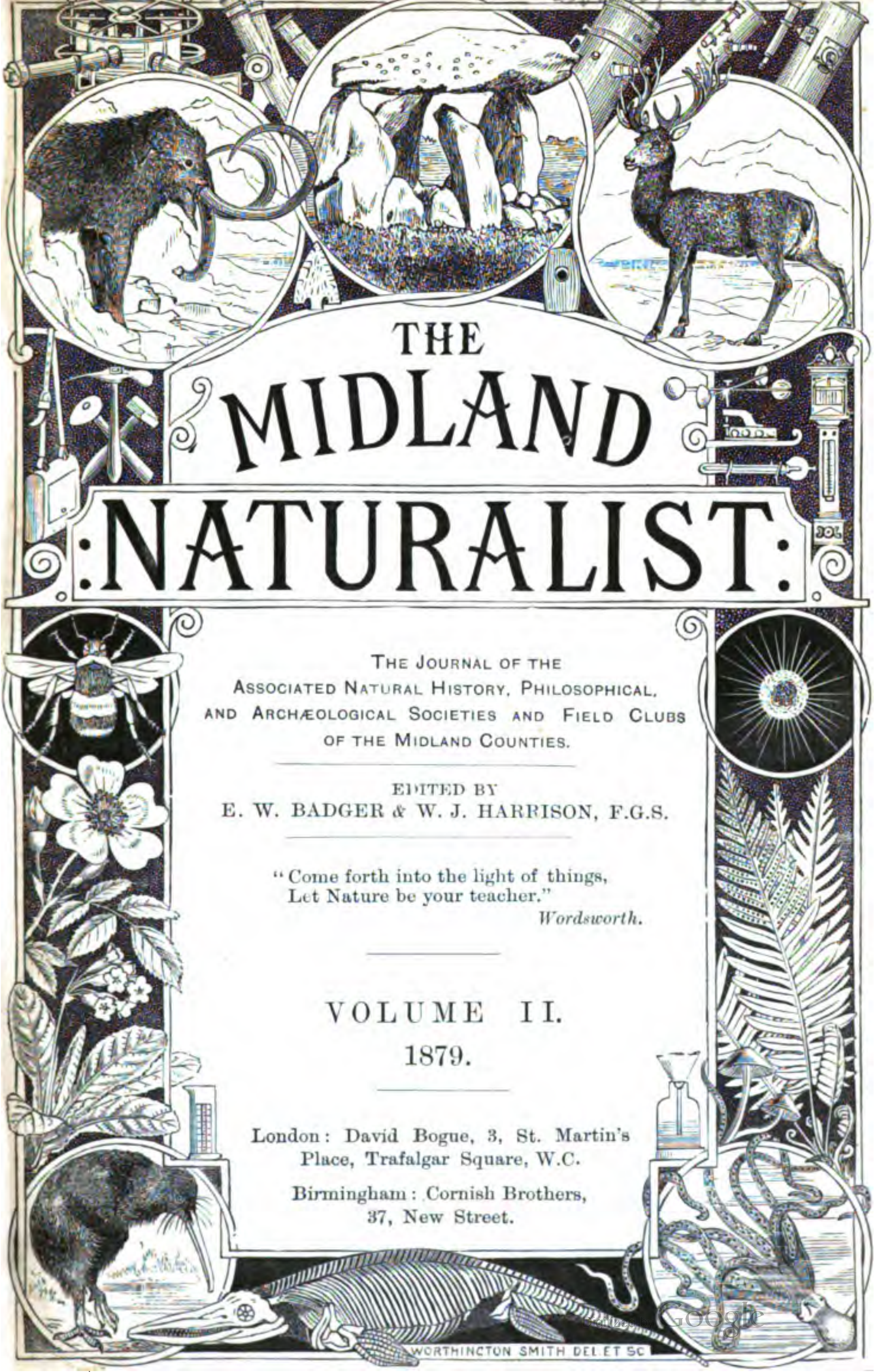
RUGBY SCHOOL NATURAL HISTORY SOCIETY.—October 19th.—The President announced that "Tree No. 10," in the School Close, had ceased to exist, and exhibited fragments from the inside of it. The holiday collections of Lepidoptera, the prize for which was gained by E. Solly, (A.) were also exhibited. The Rev. T. N. Hutchinson read a most interesting paper, illustrated by sketches made on the spot, of the "erratics" on "Norber," an outlying spur of Ingleborough, Yorkshire. He exhibited a fine *Septaria* stone from the shales of Penyghent. J. M. Wilson, Esq., read a letter from Mr. H. V. Ellis, once head of his XI., now headmaster of a young Rugby in Natal. Mr. Ellis said he should be very glad to exchange specimens, &c., with Rugby, and Mr. Wilson proposed to send him a collection of views of his old school. G. Jones (M.) gave a short account of a curious formation discovered by T. B. Oldham and himself in a brook below Shawell Church (Leicestershire.) It is probably a recent formation, though Jones thought it pre-glacial. L. Cumming, Esq., exhibited a rare orchis from Gloucestershire, *Cephalanthera rubra*, and a curious monstrosity. He then read a most interesting paper on the appearance and disappearance of some flowers. The President compared the case of the erratic appearances of some butterflies. M. H. Bloxam, Esq., exhibited a plant of the *Eucalyptus globulus*, some fragments of church tiles discovered in the parish church, also some from his own collection, and some coins and counters, one from Nuremburg, from the Church.—November 2nd. The President made various exhibitions. Mr. Percy Smith read a very interesting paper describing sugar making from first to last. Mr. Bloxam said Lawrence Sherriffe (founder of Rugby) presented Queen Elizabeth with a sugar-loaf as a new year's gift. H. J. Elsee (M.) read a paper on "Cromlechs," describing some remains he visited near Barmouth, N.W. C. E. Sayle (A.) read a paper describing a curious building he visited in the holidays near Oulton Broad, Suffolk; he also described Blunderton Church, made so famous by Dickens. J. Lea (M.) read an interesting paper on "Attractions for Moths." The President discussed the paper and the subject of "Moth Traps." Mr. Bloxam exhibited an Irish pike, 1798; improvised Hungarian swords; Joseph Addison's sword; and made some remarks on the subject.—November 16th. The President read a note from H. W. Trott (C.) on the flora of Napton-on-the-Hill; also a note from the Uppingham Natural History Society relative to a joint excursion of the two societies. The Rev. T. N. Hutchinson exhibited and explained a Jablochkoff's electric candle; also some photographs of Vesuvius in eruption. Mr. Cumming read a note on a curious growth of shoots from a tree recently cut down in the Hillmorton Road. L. F. Carleton read a practical paper on "Aquariums," discussing how to make, decorate, and stock them. The best form is an oblong, about five feet in length and 1 foot 6 inches across, with one side only of glass and the rest slate. He described the seven best fish for an aquarium, viz., stickleback, gudgeon, minnow, perch, roach, carp, pike. Mr. Hutchinson said he had kept a marine aquarium for eighteen years now, and gave some account of it. C. E. Sayle (A.) remarked on the effect music has on the fish in the Society's aquarium. Mr. Bloxam exhibited a fragment of a Roman mortarium, from Cave's Hill, with the stamp of Moricam. This is unique. Also some Shakespeare relics. He gave a description of the way MSS. were prepared for the press. He then exhibited a bag of Roman coins, some of which he distributed to the Society *passim*. The next meeting was fixed for November 30th. No more excursions will take place till spring.

STROUD NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.—November 12th.—The "Ammonia System" of water analysis was exhibited and demonstrated by Dr. Partridge, and the "Decomposition of Water by Electrolysis," by Mr. Paul Smith.

EXCHANGE.

Collections of Land and Freshwater Shells (up to seventy species,) chiefly Nottinghamshire, are offered for Natural History Text Books. Want Turton's British L. and F.W. Shells and Geological Books principally.—C. T. Musson, 68, Goldsmith Street, Nottingham.

Wanted to Exchange, good Tertiary Fossils, in splendid preservation, for good specimens found in the Silurian and Carboniferous formations.—J. Marriott, Fleckney, Market Harborough.



THE MIDLAND NATURALIST:

THE JOURNAL OF THE
ASSOCIATED NATURAL HISTORY, PHILOSOPHICAL,
AND ARCHÆOLOGICAL SOCIETIES AND FIELD CLUBS
OF THE MIDLAND COUNTIES.

EDITED BY
E. W. BADGER & W. J. HARRISON, F.G.S.

"Come forth into the light of things,
Let Nature be your teacher."
Wordsworth.

VOLUME II.
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PREFACE.

The completion of the second volume of the "Midland Naturalist" affords the opportunity for reviewing what purposes its publication has served; and the Editors feel satisfied that they will not be accused of mis-statement when they say that the monthly publication of this magazine has given an appreciable stimulus to Natural History studies in the Midland Counties. Some valuable papers on Fresh-water Life published in it show that one of the Societies in the Midland Union, at least, has been busily occupied in the study of a very fascinating and interesting branch of Natural History, and with results of a most satisfactory character. The discovery for the first time in this country of *Leptodora hyalina* and of *Daphnia Kahlbergensis* (or *Bairdii* as was at first suggested) are some of these results.

The practical papers on Entomology which have been published will, it is hoped and believed, lead to a more general study of the Insect world, especially among the younger members. A sort of reproach seems to have hung over the Midland Counties as being a district unable to afford any reward to the investigations of the Entomologist: how ungrounded

this, and how truly rich the field is, has been already conclusively shown in these pages by several valued contributors, (particularly Mr. W. G. Blatch,) to whom we express our gratitude, not only for what they have already done, but also (in the anticipatory sense of a well-known adage) for favours yet to come, on which we rest well assured both we and our readers may confidently rely.

In the admirable address delivered by the President at the annual meeting of the members of the Midland Union, at Leicester, in May last, (pp. 137-141,) some most suggestive remarks were made on the subject of noting down observations on points of natural science, and regularly communicating them for publication in the pages of this magazine. As we have frequently pointed out, it would be well if every one of our subscribers would consider him or herself as commissioned to observe and report on all occurrences of scientific interest which may happen within their knowledge. The present volume contains many interesting and valuable communications of this character, and we sincerely hope that in the coming year their number may be very largely increased.

We have again the pleasant duty of acknowledging our indebtedness to our large band of Meteorological observers for the valuable assistance we have received from them; to Mr. W. B. Grove, B.A., who has rendered us and our readers invaluable help in various ways; and to Mr. Chas. E. Scarse for assistance in the preparation of a carefully compiled Index.

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1879.

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THE MIDLAND NATURALIST.

"Come forth into the light of things,
Let Nature be your teacher."

A MARINE AQUARIUM.*

BY PHILIP HENRY GOSSE, F.R.S.

Since you wish to know some details of the construction and working of my new Marine Tank, I send you the following notes. In the spring of 1876, I determined to erect an Aquarium, the water of which should be in constant circulation; and I decided to adopt the plan of the Crystal Palace Aquarium, viz., that in which the ratio of the water in the show-tank to the water in reserve unseen, is as 1 to 5.

My old kind friend, Mr. W. Alford Lloyd, contemporary and fellow labourer from the first in aquarian development, gave me the invaluable aid of his counsel in every step of the work; ever suggesting and improving, as it went on, with a zeal which could not have been exceeded if the scheme had been his own. The mechanical contrivances and fittings were supplied by the eminent engineers, Messrs. Leete, Edwards, and Norman, to whose courtesy, skill, and thoroughness of work, I bear willing witness. The Tanks were made and put together, and the whole erected and set a-going, by mechanics of the place.

In the servants' front of my house was an apartment used as a lumber room, whose floor was about 12 feet from the ground, with a window looking N.W. This window I took out, and enlarged, for the reception of the show-tank (henceforth to be distinctively the "Tank"); and the room itself was dubbed the "Aquarium."

The window looked upon a yard, across which was an out-house used as a coal-cellar. The farther corner of this house I excavated, for the reception of a strong slate tank (the "Reservoir"), which was sunk so that its top was level with the ground.

Another slate tank (the "Cistern") was placed within the roof, immediately over the Tank, resting partly on the summit of the stone wall of the house, and partly on the rafters, which were strengthened for the purpose.

* In a letter to Mr. William R. Hughes, F.L.S., Birmingham.

These three vessels were made of squared slabs of best slate, varying in thickness from 1½in. (base) to 1in. (sides), which were bolted together with iron rods, tightened by screws and nuts at the ends. All the internal angles were filled with Portland cement. The Tank had that side which faced the interior of the room, made of ⅜in. plate-glass.

The dimensions and capacities of these vessels were as follows:—Tank 42in. long, 18in. wide, 18in. deep, in the clear; each inch of depth equal to 2·73 gallons; 49 gallons in total. Reservoir 62⅝in. long, 35½in. wide, 26½in. deep, each inch equal to 8 gallons; 210 gallons in total. Cistern 34in. long, 34in. wide, 27in. deep, holding 112 gallons.

The Reservoir in the cellar was first put together, sunk in place, proved water tight, and the earth rammed around it, in May. Early in June a water cart, viz., a hogshead on wheels, was filled thrice with the crystal water of Oddicombe shingle-beach, and emptied by a hose into it, giving me 210 gallons of pure sea-water in my Reservoir, which was protected from dust by a strong and tight cover of wood, divided and hinged in the middle for convenience of examination.

Early in September the whole apparatus of pump, pipes, valves, &c., arrived from the engineers, to be described in detail; and immediately the masonry of the house was opened to receive the Cistern and the Tank. A large opening having been made in the gable above the window, two cross-joists of 4in. square deal were inserted in the ceiling from the gable-wall to the centre beam. The base of the Cistern was got up, and laid *in situ*, square and level, save a ½in. inclination to S.W., that it might be emptyable to the last drop. A hole was now drilled in this S.W. part of the base, for insertion of the *jet pipe*, over the Tank; and another on the N.E. side, for insertion of the *warning pipe*. The sides of the Cistern were then set-up in Portland cement, bolted together, and smoothed within and without.

The base and sides of the Tank were put into place, first *tentatively*, until the Cistern, and the pump with its pipes, were adjusted; and then *finally*, cemented and bolted; and the plate-glass front was bedded in lead putty in its grooves, well worked in, and smoothed off. Before this last, however, the siphonal apparatus was prepared and affixed, which will presently be described.

Thus, then, the three continent vessels were in place, and appeared perfect. But these alone were of little avail. A large volume of sea-water, indeed, had been lying for more than three months quiescent in the lowest, dark and cool below the earth-level, and still brilliantly pure, as a tumblerful dipped out proved. But we wanted to lift this water out of the Reservoir into the Cistern in the roof, to transmit it thence into the Tank, and thence again into the Reservoir; and to do this perpetually, without an instant's intermission, day and night, by a constant circular current.

The apparatus by which this was effected I must now proceed to describe.

1.—The Pump. This was an ordinary lift-pump, of great strength, and great accuracy of workmanship, the materials of which were steel,

vulcanite and glass. The last-named material was strongly recommended to me by Mr. Lloyd, for the pump barrel; a cylinder of plate-glass turned and polished within and without, so as to be mathematically true, with turned and polished balls of glass to act as valves. These can be obtained only from one house in England, that of Chedgey, in the Borough, maker and patentee. They are in demand for vinegar and other acid-works, for the same reason that made one valuable to me. Mr. Lloyd first procured one from the maker, with much personal trouble and difficulty, so greatly does the demand exceed the supply;—and then, with characteristic kindness, compelled me to accept it as his gift. It is 3in. in diameter internally, and 8in. high; has a capacity of 1½ pint, when making its available stroke of 6in., after allowing for the thickness of the piston; and it weighs 4lbs. 12oz. For this the engineers made two metal caps, one above and one below; which were then joined by two metal rods parallel to the barrel, screwed and nutted to the caps. To avoid oscillation in pumping, the fulcrum was fixed, independent of the barrel, to the stout wooden plank which carried the pump; and a "fork and cradle" motion insured parallelism of the piston-rod by means of a "guide," also fixed independently to the plank. This relieves the barrel from all side strains, which might break it. The piston-rod was of polished steel; the fulcrum (handle) and loop of iron.

This pump, firmly affixed to a stout plank, we set upright against the wall of the Aquarium, immediately on the right hand of the Tank; and at such a height that the surface of the full Tank was level with the mid-height of the barrel. Then we firmly bolted the plank to one of the rafters of the house.

2.—The Supply-pipes. But the pump was to be a forcing pump ("lift and drive"), and not merely a lifting pump. Therefore, the valve ball, descending by the up-stroke of the fulcrum, opens a chamber, in which there is a second ball. This is so far lifted, by the in-forced water from the barrel, as to open a pipe (the Cistern supply-pipe), which proceeding up through the ceiling delivers it into the Cistern above. The Pump supply-pipe, a stout tube of vulcanite, commencing 6in. from the bottom of the Reservoir, passing over its edge, under the surface of the soil, across the yard, through the foundation of the house, up the interior of the wall, through the ceiling of the ground-floor, joins the bottom of the pump-barrel; and, at every down-stroke of the handle, delivers one and a-half pint of water from the reservoir into the glass barrel; which water is, the very next moment, by the up-stroke, poured into the Cistern above. Into the perforate bottom of the Cistern, another tube (the jet-pipe) is screwed; which, proceeding vertically downward to within close proximity to the surface of the Tank, allows the water to descend by its own gravity, and fill the Tank.

The force and rapidity, with which this descending column of water shall enter, are regulated by a series of jets, or thimbles of vulcanite, in all which a screw is cut with one common thread, to screw on the extremity of the jet-pipe. These are pierced with a minute hole, very truly drilled, whose bore is different in each, according to the special requirement of the Tank.

3.—The Waste-pipe. A vulcanite pipe leaves the right side of the Tank near the front, and carries away the spare water to the Reservoir, passing down alongside of the Pump-supply-pipe. The position of its exit, about 2in. from the margin, of course determines the level at which the water always stands in the Tank. It was at first proposed that this should be a simple pipe, screwed into a hole in the side; but this would have carried off only the surface-water. To make the circulation complete, I chose to take it from a point very near the bottom. To avoid the uncouth appearance of a pipe, however, Mr. Lloyd devised the following contrivance. A slab of slate, 2½in. wide, 1in. thick, and as high as the Tank, has a semi-cylindrical groove gouged out of one face, but not reaching quite so far as either end. Its upper end meets the hole in the side of the Tank at the surface, while its lower end meets a similar hole bored through the slab itself. The slab being firmly cemented in place, the water in the Tank, entering through the horizontal hole, rises in the hidden groove (now become a tube) till it reaches the exit-hole in the Tank, when it begins, and continues, to trickle out through the waste-pipe. Thus the Tank can never overflow, unless the inflow be more copious than the bore of the waste-pipe can carry off, or this pipe become choked. To meet the latter peril, a strainer was cemented around the interior orifice, in this form: suppose a shallow box of vulcanite, to which there is no cover; the bottom drilled with a number of holes ⅛in. wide. This is set up on one of its sides, on the Tank-bottom, with its lidless top in contact with the lower part of the slab, the perforated bottom (now become the side) facing the interior of the Tank. It is not cemented, but merely kept in position by a heavy piece of the rock-work; because I need sometimes to remove it, in order to cleanse the straining-holes. By this contrivance (while the water can freely percolate and escape), since nothing larger than the pin-holes can pass, the waste-pipe, which is of 1in. bore, clear, can never become choked.

4.—The Siphon. It was judged desirable to have the power of lowering the surface in the Tank, and even of emptying it of water, at pleasure, without dipping. For this object the waste-pipe was cleverly turned into a Siphon, in this wise. The waste-pipe, after leaving the Tank, runs horizontally for a foot, before it reaches the pump-plank, and turns to the perpendicular. In the midst of this space a stop-cock of vulcanite is inserted, which ordinarily is left open, and serves as an air-vent. But, if I wish to draw off the water from the Tank, I take the tip of the stop-cock into my mouth, and suck strongly, till the salt water comes rushing up. This should be sufficient; but in practice I find it needful to suck such a mouthful thrice at least, before the up-current of water is strong enough to pour continuously, which is manifest to the ear, as it roars down the perpendicular waste-pipe. I have carefully to close the stop-cock with my fingers at each suck, before I withdraw my mouth; or the vacuum, in part formed, would be again destroyed. The water sucked into my mouth I instantly discharge into the Tank at each effort. When the current is set up, the surface in the Tank is seen rapidly to descend, until it is as low as I wish; when, the opening of

the stop-cock destroying the vacuum, the outflow instantly ceases; and the jet-pipe in due course refills it.

5.—The Warning-pipe. In pumping, the Cistern which we are filling is out of sight in the roof above. In order to know when it is full, that we may not allow it to overflow, a small pipe is inserted into the side of the Cistern, an inch below the brim; which, leading down through the ceiling, ends at a few inches over the surface of the Tank. This is in sight of the person who is pumping, who cannot help hearing the babble of the stream, and seeing its sparkle, as it comes suddenly pouring down the warning-pipe; and he makes not a single stroke more.

These were, I think, all the essentials to the working of the scheme; but one or two additions were subsequently made, which I will describe. The jet thimbles could never be removed or replaced, without causing an annoying splash of water all around one's person and the furniture. To obviate this I had a vulcanite stop-cock inserted into the jet pipe, just above the jet. Thus I could close the pipe, before I unscrewed the jet; and I had now no more splashing. I have found this stop-cock useful in another way. When I siphon-off the water with the object of getting rid of the impalpable organic mud and humus, which commonly accumulates on the bottom, I remove the jet, and allow the jet-pipe to pour down its vertical torrent in full force. Thus all the moveable matters held in suspension, are whirled about; and very many of them are carried, in the siphon, down the waste-pipe to the Reservoir; where they settle quietly on the bottom, the organic parts dissolve, and the inorganic slowly accumulate in a thin pellicle on the bottom, requiring to be cleaned out, perhaps in a dozen years hence.

Although the sea-water originally put into the Reservoir was brilliantly clear and pure, and the wooden lid was made to fit close, we yet thought it prudent to guard against the possibility of extraneous matters being drawn into the supply-pipe, during the pumping, and so choking it. Accordingly a tight bell-shaped box of vulcanite was made to screw on to the bottom of the supply-pipe, about 6in. from the floor of the Reservoir. The bottom and sides of this box were drilled with many ⅛in. holes; so that it serves as a strainer, like that at the bottom of the waste-pipe.

The pipes were all made in lengths, with the requisite angles and connections; and were sent from London, carefully numbered, according to copious working-drawings. No bend can in the least degree be changed, vulcanite being inflexible and brittle. Every piece was fitted and screwed to its fellow, and "payed" with red-lead; some of the joints being also "served" with muslin. The lengths beneath the surface of the yard were carefully rammed with earth; and those which passed up the house-wall were secured to the joist by semi-circles of iron; and then inclosed in a narrow box of board, for facility of examination in case of need. The new window sash was now hung on hinges from the upper frame, and opened outward, to different degrees, by graduated metal quadrants, above the Tank; the area, much wider than originally, was made a bay-form recess, which allowed of a little useful angle on each side of the Tank. The pump, the pipes, the slate of the tank, were all painted

black; an ornamental rim of polished Spanish mahogany was made to sit on the edge of the tank; a curtain was hung to conceal the pump; and the room generally made presentable.

By the end of September the whole was in place, and water was admitted into the Tank. Not till the last of October, however, were organisms admitted, in the forms of growing Algæ and Fishes. For it must not be supposed that all went quite smooth. The pump would not draw at first; we found that the pipes leaked, and would not deliver, till we had had much labour. Then the pump would "go back;" the water retiring from the barrel sooner or later, after the pumping had ceased; so that sometimes it required more than a hundred strokes of the handle, before the water would rise. This difficulty still continues, in a mitigated form; it is the only one which we have never quite overcome. Then the siphon would not act at all for some time; but, after several months, one day, quite suddenly and unexpectedly, it acted perfectly, and has gone well ever since.

As soon as we were in regular work, I found that my supply of water was inadequate. Some had been wasted, too; some had leaked in the imperfect fitting of the pipes' joints. Accordingly a further quantity was brought up, which made my stock as follows:—Reservoir, 180 gallons; Cistern, 60; Tank, 40; equal to 280 gallons in all. And this quantity has never since needed to be replenished. Its quality seems to have steadily improved. Clear and bright as it was at first, and faultless as it seemed for the sustentation of animal life; it is very perceptibly better now. However it be explained, many creatures that would not live more than a few weeks, or even days, a year ago, now continue without difficulty, often coming into sight months after their introduction, in full health and beauty.

The manipulation is as regular as clock-work. On Tuesday, Thursday, and Saturday evenings, my servant pumps till the warning-pipe streams, averaging some 675 strokes. If the larger-bored jets are on, there must be supplementary pumping in the intercalated days, to a varying amount. For Fishes and the higher Crustacea, &c., we find the fuller supply of jet No. 1 requisite, and this profusion takes at least 250 strokes on each of the intercalated days. The total of 675 strokes is performed in about half an hour.

The jets I use are four; of which the orifices, perfectly true and round, graduate from the thickness of a lady's medium pin (No. 1) to that of a cambric needle, (No. 4). With No. 1, 18 pump strokes deliver an hour's supply of water into the Tank; with No. 2, about 10 strokes; with No. 3, 5 strokes; and with No. 4, about 3½ strokes. The orifice of each jet is just an inch from the surface of the Tank. A white cloud of dust-like air-bubbles is driven perpendicularly downward (about a foot with No. 1), after which they can still be followed, with a lens, careering to every part of the Tank.

This communication has already reached a length, which I greatly fear will be considered tedious. I will not then attempt to narrate my experience, as a Naturalist, in the use of the Aquarium for upwards of two years. Suffice it to say, it has been a great success; and has amply proved the value of the principle of its construction, viz., perpetual circulation, with a large reserve of water. One point I will add, which may interest some:—The total cost was covered by £60.

Sandhurst, Torquay, Nov. 20, 1878.

PARASITES OF MAN.*

BY T. SPENCER COBBOLD, M.D., F.R.S., ETC.

(Continued from Vol. I., page 328.)

Five more human nematodes remain to be noticed. Of these, two are excessively common in man, and a third, though rare as a human parasite, is very abundant in carnivorous animals. The three entozoa thus particularised are popularly known as the threadworm, the lumbricus, and the cat's worm. In the present communication I shall deal only with the first of these three common species, adding a brief notice of the Cochin China anguillules. The threadworm is just one of those species about which one does not like to say very much in public; and even that which is whispered about these entozoa in consulting rooms has to be conveyed to the victim's ears with tact and delicacy. As I have no professional motives in declaring my meaning I will mention an illustrative case, leaving it to the judgment of the Society whether the facts be published or not. An unmarried gentleman, the happiness of whose immediate future was intimately bound up with his speedy restoration to health, freely communicated to me the painful nature of his sufferings due to the presence of these little parasites. The symptoms cannot be stated in detail. Let it suffice me to say that the obnoxious guests had invaded the host by myriads, bringing their victim down to an emaciated and otherwise pitiable condition. Knowing the essential conditions of infection, I ventured to hint that the victim must in some way or other have swallowed one or more entire female parasites of this species *(Oxyuris vermicularis)*. The suggestion was a hard though happy hit; for it speedily brought the confession that in times of great distress the victim had, *en revanche*, seized hold of the living parasites and crushed them between his teeth. As, without doubt, most, if not all of the entozoa thus bitten in halves, were female worms, and as, moreover, each female parasite encloses myriads of eggs—whose contained embryos do not require a change of hosts—it is certain that thousands, not to say tens of thousands, of living germs were thus directly conveyed to the human territory. In this way the victim, originally seeking to revenge himself on the sexually mature parasites, could only have produced momentary pangs in the worms themselves, but for himself, he had thus unwittingly prepared that far more terrible and prolonged revenge which was afterwards exercised, unconsciously, by the progenies of the parent worms he had thus mutilated.

NEMATODA CONTINUED.

37.—*Oxyuris vermicularis*, Bremser.

Synonymy.—*Ascaris vermicularis*, Linneus.

Larvæ.—Only generally known in the embryonic state. Whilst within the egg they are at first tadpole-shaped, but under suitable conditions of heat and moisture they rapidly assume a vermiform character.

* Read to the Microscopical Section of the Birmingham Natural History and Microscopical Society, December 17th, 1878. On Dr. Cobbold's behalf Mr. W. R. Hughes, F.L.S., exhibited specimens both of human and equine threadworms (*Oxyuris vermicularis* and *O. curvula*). The latter species is better known as the pinworm of the horse; female examples sometimes attaining a length of nearly five inches.

Intermediate host.—Not required.

Experiments.—Leuckart reared intra-ovular vermiform embryos by placing the eggs in moistened paper envelopes and exposing them to the action of the sun's rays. Heller reared them in glass tubes filled with saliva and carried about under the arm-pits. Heller and Zenker possessed themselves of specimens of the higher larvæ from the small intestines *(post mortem)* in a case where the patient had swallowed the eggs some days previous to his death. I caused a monkey to swallow a quantity of eggs in the hope of rearing the adult parasites, but the the result proved negative. Possibly at the *post mortem* examination I overlooked the existence of larvæ, but I do not think any were present. Lest some persons should suppose this kind of experimentation to be unwarrantable, I may remark that it had for its object the alleviation of human suffering. Others have experimented upon themselves with the same benevolent purpose. Thus, Professor Leuckart and three of his pupils infested themselves by courageously swallowing a quantity of the ova. They certainly enjoyed the satisfaction of subsequently supplying ocular proof of the success of their worm-feedings.

Remarks.—The common notion that these parasites breed within the human body is an error, and it is equally incorrect to say that they reside in the lowermost part of the intestinal canal. Their head-quarters are the cæcum and upper part of the colon. It is true that Vix and Leuckart have noticed embryos within the large intestine; but Leuckart, Heller, and myself alike regard this intestinal hatching as an unusual occurrence. For the purposes of infection it is alone necessary that the eggs of the worm be conveyed to the mouth and swallowed. Their previous immersion in water for any length of time secures their destruction, by the bursting of the egg-shells consequent upon endosmosis. The eggs are conveyed to the mouth in various ways. Ordinarily, children become infested by biting their nails, beneath the margins of which the eggs lie concealed. Professors Heller, Zenker, and myself have, all more or less, frequently had occasion to demonstrate this fact to our patients. Occasionally, the eggs are swallowed by accident during sleep. Still more rarely whole parasites may be conveyed to the mouth in a similar manner. In whatever manner they may have been conveyed to the bearer, when once the eggs have gained access to the stomach, their shells are dissolved by the action of the gastric juice, and the larvæ are liberated. In the upper intestine the larvæ grow rapidly. Here they undergo one or more changes of skin; acquiring sexual maturity within a period of less than a month.

Literature.—All standard works. See also my lectures on Helminthology, ("Worms,") and more particularly the very admirable article (Darmschmarotzer) by Heller, in Von Ziemssen's "Handbuch," or the recently issued American edition of the same work.

88.—*Leptodera stercoralis*, Bavay.

Syn.—*Anguillula (Rhabitis) stercoralis*, Bavay.

Larvæ.—These are at first known as minute embryos, measuring only $\frac{1}{130}$ of an inch in length. Subsequently, in the condition of immature rehabitiform larvæ, they acquire a length of about $\frac{1}{50}$ of an inch. All their changes of size and shape, accompanied by ecdysis, are undergone within the human intestine. Under

favourable circumstances, five days are fully sufficient for the complete development and maturation of the parasite.

Int. Host.—Not necessary.

Experiments.—None.

Remarks.—In the full grown state this little nematode is stated to be only the $\frac{1}{90}$ of an inch in length. It was discovered by Dr. Normand in excrementitious matters passed by French soldiers suffering from the so-called Cochin China diarrhœa, and who had been sent home as invalids. This entozoon, by its injurious action, supplies another remarkable instance of parasitism as a cause of endemic disease. Drs. Normand and Bavay state that the victims are infested to such an extent that the number of little worms present in severe cases can only be adequately estimated at many hundreds of thousands. Their extreme rapidity of growth and maturation readily accounts for this excessive degree of infection, which is maintained with much persistence, in spite of the dysenteric action which daily expels myriads of the parasites in every stage of development. I may add that *post mortem* inspection has shown that the anguillules not only occupy all parts of the alimentary canal, from the stomach downwards, but that they also find their way into the pancreatic and biliary ducts, and even into the gall bladder.

Lit.—Normand (Dr. A.); Memoire sur la diarrhée dite de Cochinchine, in Archives de Médicine Navale, for Jan., 1877, and especially his recent article "Du Role Etiologique de l'Anguillule, *Ibid.*, Sept., 1878, Bavay; in Comptes Rendus, for October, 1876.

39.—*Leptodera intestinalis*, Bavay.

Syn.—*Anguillula (Rhabditis) intestinalis*, Bavay.

Larvæ.—Similar to those of *Leptodera stercoralis*, but relatively larger, and possessing a remarkably long œsophagus, together with a blunt instead of a sharply pointed tail.

Int. Host.—Not necessary.

Exper.—None.

Remarks.—The full grown worm is almost three times the length of the preceding species. In the Cochin China victims, it is frequently, though by no means invariably, associated with its smaller and far more abundant congener. In consequence of its occurring in comparatively small numbers, it is not easy to state to what extent this worm is concerned in the production of disease. Were it as abundant as *Leptodera stercoralis*, it would doubtless prove more destructive to the human bearer.

Lit.—Bavay; Note sur l'Anguillule intestinale; in the Archives de Méd. Navale for July, 1877.

[TO BE CONTINUED.]

THE GEOGRAPHICAL DISTRIBUTION OF PLANTS AND ANIMALS.

ABSTRACT OF AN ADDRESS DELIVERED TO THE CHELTENHAM NATURAL SCIENCE SOCIETY, BY H. J. ELWES, ESQ., F.Z.S., F.L.S., &c., ON NOV. 21, 1878, AND THE DISCUSSION THEREON.

Mr. Elwes remarked that the geographical distribution of animals and plants is a subject which, until a few years since, was scarcely thought of by Naturalists, but has recently received much attention

from several of our most eminent scientific men. Nor is this surprising, when we consider the many points of the greatest interest, whether to the geographer, geologist, or others, which are brought under consideration, and how much light is thrown upon the history of the changes which have passed over our globe. After reviewing the various authors who have been most instrumental in ascertaining and explaining the various facts which have been observed, he continued that time would not permit his entering upon minute details, but proposed confining his remarks to a sketch of the most characteristic features of distribution, the reasons for which he would not touch upon, as, however ingenious and even probable might be the hypotheses which had been suggested as explanations, the majority of them were incapable of proof. From a zoological point of view, the great divisions of the world were as follows: —I. *Palæarctic*, divided into four sub-regions: (1) European, (2) Mediterranean or Mediterraneo-Persic, (3) Siberian, and (4) Mantchurian or Mongolian. The boundaries of each of the foregoing and following regions were defined, it being especially noticed that deserts and seas form the most natural ones; II. *Ethiopian region*, subdivided into (1) East African, (2) West African, (3) South African, and (4) Madagascar; III. *Oriental region*, subdivided into (1) Indian, (2) Ceylonese, (3) Indo-Chinese or Himalayo-Chinese, and (4) Indo-Malay or Malay; IV. *Australian*, subdivided into (1) Austro-Malayan, (2) Australian, (3) Polynesian, (4) New Zealand; V. *Neotropical*, subdivided into (1) Chilian, (2) Brazilian, (3) Mexican, and (4) Antillean; VI. *Nearctic*, subdivided into (1) Californian, (2) Rocky Mountains and Plains, (3) Alleghanies and Eastern United States, and (4) Canada. The foregoing divisions are made more upon zoological than botanical considerations, but in the main apply to both. The Palæarctic region, though of immense extent, does not contain throughout its northern and largest portion anything approaching to the same variety or number of species that are found in other regions of much less extent. Warblers, buntings, thrushes, grouse, waders, and waterfowl, are the most abundant and conspicuous families of birds. Deer, wild goats, sheep, and rodents, are the most characteristic animals. Coniferæ and hard-wooded timber trees, fruit trees, and herbaceous plants and grasses, are the most remarkable and useful among the vegetable forms. About 900 species of birds only are found in the entire region, of which not more than 200 or 250 at the most are resident in any one district; but we see in the Himalayas, and in some parts of Central and South America 600 or 700 species existing within a radius of fifty miles. Insects, butterflies, and beetles, are fairly represented; but in Europe these appear to increase in numbers and variety as we proceed from N.W. to S.E. In the Mediterranean, the number and variety of the plants become proportionately much greater, especially in the bulbous forms. The Mantchurian sub-region is characterised by the presence of many remarkable forms, as the wild camel on the steppes of the N.W. Tibet, and the yak, the saiga antelope, the great wild sheep of the Pamir plateau, and among birds especially by the pheasants. Its flora (except on the coast of China and Japan) is marked by the absence rather than the presence of peculiar or remarkable plants; that of the plateaus and

highlands of Central Asia being poor and stunted, as might be expected from the severity of the climate. There is an intimate connection between physical geography and distribution of animals and plants which enables one to predict with tolerable certainty the character of the fauna and flora of any newly explored tracts. The oriental region having been already alluded to, it was necessary to offer a few remarks upon its subdivisions, and first of all on that of Ceylon. This sub-region (which includes the western parts of India) possesses some forms of animal life which are not present in the Indian sub-region, such as some mammals, as lemurs, tupaia and monkeys, as well as reptiles. Thus the Uropeltidæ and other genera of snakes and lizards are peculiar to it. The insects are more akin to those of Malayana than of India. The fishes of the Malay sub-region confirm the justice of its separation from the Australian region, for the fresh water forms of Siluroids and Cyprinoids, consisting of thirteen genera of the former and twenty-three of the latter, range to Java and Borneo, but do not extend further. The Ethiopian region shows a great variety and abundance of large mammals with an absence of bears, deer, goats, and sheep. The East African sub-region is the least peculiar portion of Africa, and is perhaps not so well marked as the West, which latter is the home of the anthropoid apes, in fact this sub-region has a Malayan affinity. The South African sub-region is the most peculiar and interesting of the three, especially as regards its botany. It has great numbers of heaths, bulbous and succulent plants, composites, &c., and an abundance of large game. The Madagascar sub-region is very peculiar; it is the land of the lemurs, and in fact if we received a curious bird, having very slight affinities to anything known, we should at once suspect that its native home must be Madagascar. The Australian region is very well marked: amongst mammals it is deficient in the orders present in the other regions, except bats and some rodents, while the great family of marsupials is almost restricted to it, the ornithorhynchus and echidna are peculiar to it. The birds are not quite so restricted to this region as the mammals, but we find the lyre birds, parrots, megapodes, emus, cassowaries, birds of paradise, and some curious pigeons. The Polynesian birds are very few in numbers, while mammals are absent. The New Zealand fauna is likewise very peculiar, among its birds is or was the moa; while species of another wingless family, Apteryx, still linger; there are, likewise, peculiar parrots, as the nestor and the stringops, the curious notornis among the rails, and the unique anarhynchus among the Charadriidæ. We find a great poverty of insects, only eleven species of butterflies and no snakes. It is curious what a deficiency of hardiness exists in Australian plants as compared with those of some other regions; rapidly succumbing before introduced species, many of them are with great difficulty, if at all, raised in other climes.

Mr. Symonds congratulated Mr. Elwes on the interesting address which he had just delivered, wherein he had illustrated point after point with great clearness.

Mr. Longe, Rev. W. Boyce, and Major Barnard made observations upon the failure of New Zealand plants in this climate.

Sir William Guise remarked upon the utility of such investigations as those of Mr. Elwes, wherein facts were being investigated with reference to what they tell us of the past history of the globe. Theorists had accounted for some phenomena by suggesting the existence of submerged continents or islands that appeared to be constantly dipping up and down, but the Challenger had shown that where one of these continents was supposed to exist the depth of the sea is such that it would cover the highest mountains now extant. Some facts had not been explained, for instance the peculiar flora of St. Helena, or the large tortoises of the Galapagos islands, and we required more workers such as the author of the present paper, to continue their investigations, for we wish to know how these animals and plants got there, and what relationship they have with other lands.

Mr. Day remarked that he had been investigating the geographical distribution of the fresh water fishes of India, and his conclusion as to the sub-divisions of the Indian region coincided with Mr. Elwes', that there were three separate fish-faunas—the first on the primary hills of the western Ghauts, extending into Ceylon, and on the Malay Archipelago, by way of the Andaman Islands, and also identical with some Himalayan forms; secondly, an African element, which had entered India by way of Syria, along with some palæarctic genera; and, lastly, a Malayan form, which had been derived by way of Burmah and Siam; and that these last two met in the Hindustan sub-region, where the land was of tertiary formation, with here and there secondary rocks cropping out.

Dr. Wright congratulated the meeting on the observations on the geographical distribution of animals and plants they had heard that evening. The subject was almost a new one, and was only a fragment of the truth, the last condition of the earth's surface presented to the investigation of man. The geological evidence tells us of a Mediterranean fauna which existed in the Arctic regions. In Australia we find an old race of fossil kangaroos, to which those existing are mere pigmies. The same with the South American armadillo. Facts still require to be collected, and in time we may obtain sufficient evidence to work out the problem we are now seeking to discover.

Mr. Elwes having replied, the meeting adjourned.

THE BLADDERWORTS AND THEIR BLADDERS.

BY W. SOUTHALL, F.L.S.

A notice of a habitat of *Utricularia intermedia* may be of sufficient interest to merit record. I found the plant this autumn near a little tarn on the left of the road from Coniston to Hawkshead, Lancashire, a little below the water-shed on the Coniston side. The tarn itself has a boggy margin, and is girdled with a more abundant vegetation than is usual around the tarns of the Lake district; various sedges, the white water lily, and the buckbean, forming the larger portion of it. The season was too late for most flowering plants, but a few, as *Sparganium minimum*, a somewhat rare plant, were still in flower. Around the larger pool were some small pits of peaty water, and in several of those grew *U. intermedia*, and in others *U. minor*; but, as far as my observation went, the two species were not intermingled. It is stated in Darwin's

"Insectivorous Plants" that they (the Utricularias) "commonly inhabit remarkably foul ditches." Here, the water was bright, as was also the case in the only other place in which I have seen a Bladderwort growing, namely, in Connemara. It is also stated in the same work, on the authority of Warming, that "they are quite destitute of roots even from the earliest period of growth, and float near the surface of the water." These plants were certainly attached to the bottom. As to the presence of true roots I cannot speak with certainty, as I had not read the above at the time, and did not pay sufficient note; but I brought away from the most shallow pool a piece of the turfy bottom undisturbed, on which two young plants were growing. They continued to grow when placed at the bottom of a glass vessel, about a foot below the surface, and never evinced any disposition to float to the surface. But the Bladderworts seem more amenable to the attacks of both mollusks and confervæ than any others of the small water plants in the same vessel, and the plants are consequently at present in a poor condition. Their gemmæ evidently have powers of resistance beyond the other portions of the plant, and will, I trust, grow next year. I should add, the observations recorded in "Insectivorous Plants" have mostly reference to the species *neglecta* and *vulgaris*.

An after-examination of the contents of the bladders by the microscope afforded a particularly interesting series of objects, the number and variety packed within some of them causing me to wonder how they could have got inside. Entomostraca are prying and lively enough to penetrate into any odd corner; but in many of the other captives the power of locomotion is at all events very slow and obscure. There are, it is true, two long bristles or antennæ that spring from either side of the valvular opening of each bladder, and these may act as guides to it, whilst the numerous short bristles surrounding the entrance prevent escape. The long antennæ in some bladders project directly forward from the bladder, and in others are bent round underneath. There were bubbles of air in many of the bladders. The foreign contents were largely living, but also dead and decomposed in the state of a sort of muddy pabulum. With the assistance of my friend, Mr. J. E. Bagnall, the following list of the contents has been drawn up:—

VEGETABLE FORMS.—Motile forms of a unicellular alga very like Protococcus. A unicellular alga like Pleurococcus in series of four cells, the inner portion green, the outer part of the cells hyaline. Amongst Desmids: Cosmarium in conjugation, three species of Closterium—some of the bladders contained a large number of these; Penium, Euastrum, Ankistrodesmus, Micrasterias frequent. Of Diatoms: *Meridion circulare*, species of Naviculare and others. Cells of algæ, Tyndaridea, and others.

ANIMAL FORMS.—Of Rhizopods: Difflugia abundant in one bladder, Arcella, and a peculiar bowl-shaped species. Of Entomostraca: *Alona ovata*, numerous and lively; Cypris, Cyclops, Daphnia. Rotifers: *R. vulgaris*, and other species. Infusoria: Chilodon and Paramecium. Of the smaller algæ, and Desmids particularly, various stages of growth were represented. Probably more time and research would have resulted in a yet larger list of prisoners. The bladders of *U. minor*, not only from being most numerous, yielded the best results. I was surprised at the large proportion of animals in a living, or at all events undecayed condition. Some of the Crustaceans must have lived inside the bladders for many days if not a week or more. For instance, the *Alona ovata*, which as far as my knowledge went did not exist in the water in which the plants were placed away from other plants. I may add that perhaps a month afterwards I examined three bladders that had been detached and remained at the bottom of the bottle. The walls had become very thin, but had retained

their shape. Within there was abundance of *debris*, but no muddy solution. All traces of Entomostraca, except a few plates, jaws, &c., had disappeared, though Cyclops was living in the water; the Desmids were in full vigour, and algæ had grown *within* the bladders, one bladder being almost full of Tyndaridea closely coiled.

Reviews.

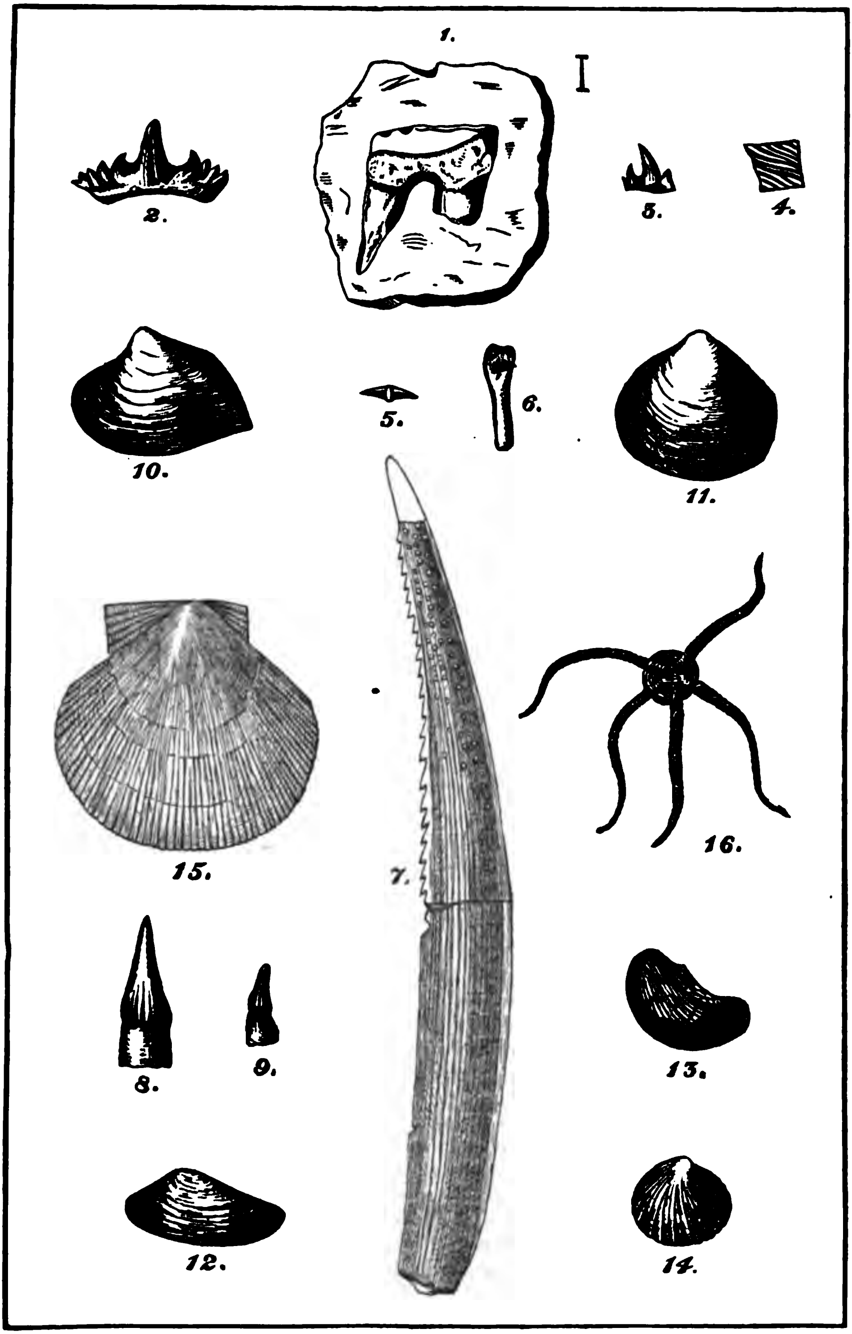
Proceedings of the Dudley and Midland Geological and Scientific Society and Field Club. No. 5, Vol. III., December, 1877. Dudley: Samuel Mills.

This part brings down the proceedings of the Dudley Society to the end of 1877. It is full of most excellent matter; and other societies may learn much from it how to chronicle their proceedings in a satisfactory and useful manner. Judging the Society by this record of its work, it is evidently interesting its members in local geology, and placing on record facts which will be of use to future geologists. The present part contains accounts of the Field Meetings in 1877, which included visits to the neighbourhood of Walsall, to Droitwich, where the Rhætic Beds at Dunhampstead were examined, the neighbourhood of Dudley, following the walk described by Hugh Miller in his "First Impressions of England," to the Stiperstones and the Snailsbeach Lead Mines, to Ludlow, to Ross, Chepstow and the Wye, and to Cannock, where they were joined by the North Staffordshire Naturalists' Club. There are papers on "A Railway Cutting at Daw End, near Walsall," by Mr. J. W. Oliver; on "A Photograph of a Section of Wenlock Shale from the Wren's Nest, taken from a sketch under the microscope," by Mr. Terry; "Analyses of various Limestones," "On the Rhætic Section at Dunhampstead Cutting, near Droitwich, and its correlation with the same strata elsewhere," by Mr. W. J. Harrison, F.G.S.; "On Salt," by the Rev. J. H. Thompson; "On the Parkfield Fossil Forest," "On an Ink Photograph of the Fossil *Aëtosaurus Ferratus*," Fraas, "On the Botany of the neighbourhood of Ross and the lower portion of the Wye Valley," by Mr. Hy. Southall; "On the Contents of a Hyæna's Den on the Great Doward, Whitchurch, Ross," by the Rev. W. S. Symonds, F.G.S.; "The Bunter Conglomerates of Cannock Chase," by Mr. W. Molyneux, F.G.S.; and "Registers of Rainfall in 1876-7, at Pedmore," by Mr. E. B. Marten, the painstaking secretary of the Society. These Proceedings are well illustrated. We subjoin, as a specimen of the illustrations, woodcuts of the following Rhætic fossils:—

Fig. 1.—*Microlestes Rhæticus*, Owen.
Fig. 2.—*Hybodus reticulatus*, Agassiz.
Fig. 3.—*Hybodus minor*, Ag.
Fig. 4.—*Gyrolepis Alberti*, Agassiz.
Fig. 5.—*Acrodus minimus*, Ag.
Fig. 6.—*Sargodon tomicus*, Quenstedt.
Fig. 7.—*Nemacanthus monilifer*, Ag.
Fig. 8.—*Saurichthys apicalis*, Ag.
Fig. 9.—*Saurichthys acuminatus*, Ag.
Fig. 10.—*Axinus cloacinus*, Oppel.
Fig. 11.—*Cardium Rhæticum*, Merian.
Fig. 12.—*Anoplophora musculoides*, Schlotheim.
Fig 13.—*Avicula contorta*, Portlock.
Fig. 14.—*Monotis decussata*, Goldfuss.
Fig. 15.—*Pecten Valoniensis*, Defr.
Fig. 16.—*Ophiolepis Damesii*, Wright.

In our correspondence will be found an interesting note on these Proceedings from the pen of Mr. W. Whitaker, F.G.S.

E. W. B.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Practical Geology. By W. Jerome Harrison, F.G.S. London: W. Stewart and Co. Pp. 157, forty-two illustrations. Price 2s.

Among the many text-books of Geology it is a difficult, and in some cases a delicate task to recommend to the student which particular works to read. He cannot commence with too simple a work, one which interests the reader and conveys to him a general idea of the principles of geology; and once gaining the interest, he will be tempted to undertake the reading of some more advanced volume. There is a danger, however, to the student when pushing on his enquiries into the larger manuals, of becoming to some extent wearied with details, which observation will not enable him to enliven. Hence the great value of some practical experience in the field. Indeed, Mr. Harrison tells us how he attributes the success of his geological classes to a constant insistance on the necessity for field work, combined with the close examination, sketching, &c., of models and specimens; for an acquaintance with a few facts will enable the young student to appreciate the many. In the same way, even a hurried visit to a previously unseen tract of country will enable the more advanced student to read with interest and intelligence memoirs that previously seemed dry and uninviting.

In the little work before us, Mr. Harrison has furnished the young student who is ready and anxious to go out in the field with a guide and companion, who tells him what and how to observe. Commencing with an account of the apparatus necessary, the author gives instructions how to set to work, and then takes his readers over all the British formations, pointing out their leading characters and fossils. So that the student who is possessed of a geological map, and will read the descriptions here furnished, with the map before him, and who will use every opportunity of taking both into the field, may soon expect to become a good observer.

The work is full of useful suggestions; and, besides the purely descriptive portions, Mr. Harrison takes care to combine many explanations of facts, as well as notes on the physical history of the deposits and on foreign strata. If some of the formations with which he is more intimately acquainted receive an apparently undue share of attention, as, for instance, the chapter on the Rhætic Beds, compared with that on the Silurian Rocks; this is a very pardonable favouritism, rather than offence. The work has been most carefully prepared and edited, and contains references to all the more important researches made known up to the time of publication; and the way in which the subject is treated, giving evidence of much personal observation and thought, and of much heartiness and enthusiasm in the cause of geology, give us great pleasure in recommending it to all desirous of becoming practically acquainted with the geology of their country.

H. B. Woodward.

The Eruptive Rocks of Brent Tor and its Neighbourhood. By FRANK RUTLEY, F.G.S., Geological Survey Memoir. Price 15s. 6d. 1878.

SURELY the memoirs of the Geological Survey must be of a very bashful and retiring nature, for the amount of "introduction" which they require on making their appearance in public is something remarkable. Here we have a small pamphlet of fifty-five pages in a paper cover. The first page, in large print, is occupied by Professor Ramsay, the Director-General of the Survey, with some general introductory remarks. Then, in smaller letters, Mr. Bristow, the Senior Director, paraphrases Professor Ramsay—or, perhaps, we ought rather to say the matter is *vice versa*, as Mr. Bristow's "Notice" is dated a week the earlier of the two. Lastly, in still smaller type, as becomes his junior official condition, the author's "Preface" appears.

The first chapter consists of some very useful introductory remarks on the use of the microscope in petrographical research. In connection with this matter, it is greatly to be wished that some competent worker, such as Mr. Rutley himself or Mr. Sorby, Mr. Allport or Professor Bonney, would write us an English text-book on the subject. At present we are mainly dependent on the Germans, Rosenbusch and Zirkel.

The next chapter gives us a description of Brent Tor and its neighbourhood. It is situated on the west of Dartmoor, between the Rivers Tamar and Tavy. This district was geologically mapped by the founder of the survey, the late Sir Henry de la Beche, in 1839. One would have thought that a fresh map of the district on the 6-inch scale would have been undertaken prior to the publication of this Memoir; and there can be no doubt that, if Mr. Rutley had had such a map to aid him, his labours would have gained greatly in precision and certainty.

In Part II. we find the result of the microscopic examination of twenty-seven rock specimens, thirteen of which are illustrated by very carefully executed coloured figures; this is decidedly a valuable contribution to the subject. Finally, the author states the "deductions" which, in his opinion, are to be drawn from the mode of occurrence of the rocks in the field, together with the evidence they yield under the microscope. He agrees with De la Beche in considering Brent Tor a fragment of the nucleus of an old volcano, while the schistose ash beds of the neighbourhood possibly emanated from it, both being of carboniferous age. These beds owe their preservation to their being on the downthrow side of a fault ranging from N.W. to S.E., along the eastern edge of the Tor. From a reference on page 78, this work appears to have been written nearly three years ago, although only now published; and this delay of publication also applies to most of the other Memoirs of the Geological Survey, a delay which is neither just to the authors nor to the public.

Mr. Rutley's abilities with the pencil are well known, and this book is illustrated with six plates and ten woodcuts, which deserve much better paper than that upon which they are printed. The four plates of chromolithographs of microscopic sections we have already referred to.

W. J. H.

Microscopy.

Having lately had the privilege of using one of the new Oil Immersion ⅛th, made by Zeiss, of Jena, from calculations of Professor Abbe, and on a design of Mr. Stephenson, F.R.M.S., [See Vol. I. (1878) Journal of R.M.S., p. 51,] I would strongly urge on all who can afford to buy one to order a glass forthwith. I have been engaged during part of this year in examining slides of the mastax of *Melicerta ringens*, sent to me by the Rev. Lord Sydney G. Osborne, and have written a paper on them, which has been published in the current transactions of the Royal Microscopical Society; but, unfortunately, I had not had, before writing my paper, the privilege of viewing the slides through this Oil Immersion ⅛th. I have since had that privilege, and I must almost re-write the paper. It is simply a magical instrument for bringing out *structure* for a laminated surface, which, under an ordinary ⅛th, looks not merely transparent, but empty of superficies, like a window-frame with the glass out, becomes under this glass one mass of fine lines. Parts of the mastax of Melicerta, which I had treated like unoccupied frames, are seen under this power to be "full of matter"—that is to say, solid areas of transparent texture. The glass will not supersede the ordinary ⅛th, because it is useless for such intermediate fluids as water; but for all objects immersed in the ordinary fluids used in mounting objects for the microscope, it will be found to be a great addition to our instruments. This specimen glass was lent me by Mr. Frank Crisp, Secretary R.M.S., who, I believe, has been amongst the first observers who have realised the value of the new power. To gentlemen engaged in the study of tissue and minerals, or, indeed, of any transparent objects which will bear immersion in balsam, this glass will prove of great importance.—F. A. Bedwell

At a recent meeting of the Birmingham Natural History and Microscopical Society, Mr. H. E. Forrest exhibited and described a simple and easy method of drawing objects under the Microscope. The apparatus consists of a three-sided prism, fitted to slide on to the eye-piece of the Microscope, and capable of being adjusted to any angle. The Microscope is put in a horizontal position, and the light thrown by a condenser straight up the tube. The lamp is enclosed in a box or cylinder, with a hole on one side the size of the condenser, in order to shut off all unnecessary light. The room being darkened, the image of the object is seen thrown on to the paper placed underneath, and has merely to be traced over with a pencil. The size of the drawing is governed by its distance from the prism; the rays diverge, consequently the further the paper from the prism, the larger is the picture; and by placing the paper on the floor, an image may be drawn 4ft. or 5ft. in diameter. The advantages claimed for this little instrument by Mr. Forrest are simplicity, cheapness, and superiority to the camera or neutral tint glass, in that it really throws the image on to the paper instead of only apparently doing so. As seen in operation at the meeting, one disadvantage was apparent. The loss of light was so great that it was

impossible to use the prism with high powers. Subsequently, Mr. Forrest has made a great improvement, suggested to him by Mr. T. Waller. He now uses a rectangular prism, instead of the equi-angular one exhibited at the meeting, and he informs us that the light both enters and leaves the prism perpendicularly; by this means the loss of light is inconsiderable, and even diatoms may be drawn with a $\frac{1}{8}$ objective. The position of the prism in relation to the eye-piece is as follows:—The base is parallel to the horizon, the other equal side being parallel and close to the eye-piece; the hypothenuse thus making an angle of 45° with both the horizon and eye-piece.

A valued correspondent sends the following note on "Microscopic Objectives." He says "That well-known optician, Mr. Swift, of London, informs me that 'at the beginning of the new year I am going to cut the price of my objectives down to those of the best continental makers; quality at same time will be guaranteed.' I have seen and worked with many of Hartnack's instruments, but have no hesitation in declaring that a 'College Microscope' I have lately had from Mr. Swift is superior to any Continental model."

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF NOVEMBER, 1878.

BY W. JEROME HARRISON, F.G.S.

The month opened with a few days of fine weather. Of this time the Rev. J. S. Barber (Spondon) says: "Bees were exceedingly active, and could be heard at considerable distances from their hives. They were busy upon all flowers, especially those of mignonette." But this was not to last; soon the traditional fogs set in, the thermometer fell with cold northerly winds and snow, and so continued to the end of the month. Rainfall was about an average. At the westerly stations the 9th was almost without exception the day of maximum fall, which in several places exceeded one inch, and produced slight floods. A storm on the 15th produced the maximum fall in the central counties, while the 24th gave a similar result in the East Midlands. On the morning of the 12th snow covered the ground generally to a depth of three or four inches, and there was another pretty general fall on the 24th. The nights were cold and frosts numerous. At Stoney Middleton "the minimum thermometer recorded below 32° every night during month." Dense fogs prevailed from the 18th to the 21st. Gales from the North occurred on the 9th (when barometer fell ·882in. in twelve hours at Cheltenham) and 15th. Lightning was seen at Oxford on the 18th, and lunar halos on the 6th and 11th. A lunar rainbow was seen by Mr. Griffiths at Bishop's Castle on the 10th, and a solar halo at Loughborough (Mr. Berridge) on the 23rd. At Tamworth, "an immense quantity of cobweb was noticed on the grass on the 20th." Winter birds, as the Fieldafre and Redwing, seem very numerous, and at Nottingham Mr. Johnson states that they have taken a great number of the holly-berries.

STATION.	OBSERVER.	RAINFALL. Total for M. In.	Greatest fall in 24 hours. In.	Date.	No. of rainy days.	TEMPERATURE. Greatest ht. Deg	Date.	Great'st cold. Deg	Date.
GLOUCESTERSHIRE.									
Cainscross, Stroud	W. B. Baker, Esq.	2·88	·74	9	10	56·0	1	24·0	29
Cheltenham	R. Tyrer, Esq.	3·00	·64	19	16	61·2	10	20·0	29
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	3·60	·77	10	13	47·0	9	21·0	27
Whitchurch	A. B. George, Esq.	3·77	·40	9	14	....			
Woolstaston	Rev. E. D. Carr	4·22	1·07	9	21	50·0	9	22·5	21
Leaton Vicarage, Shrewsbury	Rev E. V. Pigott	3·19	·66	9	13	50·6	10	23·7	26
More Rectory, Bishop's Castle	Rev. A. Male	4·78	1·00	9	21	48·0	9	23·0	12
Larden Hall, Much Wenlock	Miss F. R. Boughton	2·68	1·12	9	11				
Bishop's Castle	E. Griffiths, Esq.	4·28	1·02	9	22	50·0	9	25·0	12
Cardington	Rev. Wm. Elliott	3·84	1·09	9	16				
Adderley Rectory	Rev. A. Corbet	2·55	·71	9	16				
Stokesay	Rev. J. D. La Touche	3·60	·93	9	15	51·9	10	25·0	12 & 27
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	3·08	1·06	9	14	....	....	24·0	29
Stoke Bliss	Rev. G. E. Alexander	3·06	1·22	9	14	51·0	9	29·0	26 & 28
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq	3·21	1·10	9	14	50·3	8	27·0	27
West Malvern	A. H. Hartland, Esq.	2·71	1·00	9	13	47·0	9	28·0	28
Pedmore	E. B. Marten, Esq.	3·24	·91	9	13	53·0	19	27·0	28
Stourbridge	Mr. J. Jeffries	3·15	·84	9	13	48·0	8, 9. 18	26·0	12 & 26
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	3·08	·69	9	14				
Barlaston	W. Scott, Esq	2·65	·65	15	10	49·8	18	19·2	28
Amblecote	Mr. J. Robins	3·09	1·00	9	11				
Dudley	Mr. J. Fisher	3·21	·82	9	13	50·0	9	28·0	11 & 28
Sedgley	Mr. C. Beale	[illegible]	·74	9	14	46·0	9	29·0	1 . 28, 29
Kinver	Rev. W. H. Bolton	2·83	·86	9	11	47·0	9 & 17	28·9	2 12, 22,
Walsall	Mr. N. E. Best	3·94	·97	9	11	45·0	10	29·0	28 (25,26
Grammar School, Burton	C. U Tripp, Esq.	2·71	·51	9	19	50·0	1	25·0	27
Patshull Gardens	Mr. T. W. Dell	2·95	·75	10	10	54·0	4	25·0	27
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	2·97	·78	9	16	48·0	9	25·0	27
Wrottesley	E. Simpson, Esq.	2·69	86	9	11	49·0	10	26·4	29
Tamworth	W. Arnold, Esq.	2·63	·55	9	12				
Tean Vicarage, near Cheadle	Rev. G. T. Ryves	2·72	·67	15	14	47·5	2	22·0	12
Heath House, Cheadle	J. G. Philips, Esq.	2·37	·56	15	11	47·0	2, 10, 18	24·0	21
Alstonfield Vicarage	Rev. W. H. Purchas	3·32	·72	9	11	48·1	1	19·0	21
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	3·42	·77	15	16	47·0	9 & 10	29·0	22 & 28
Coventry	J. Gulson, Esq.	3·51	·78	15	17	50·0	10	29·0	28, 29.30
Bickenhill Vicarage	J. Ward, Esq.	3·02	·96	9	16	47·0		28·0	
St. Mary's College, Oscott	Rev. S. J Whitty	2·84	·70	9	13	47·8	10	28·4	29
Henley-in-Arden	T. H. G. Newton, Esq.	3·98	1·40	10	12	50·0	10	28·0	12, 28, 29
Rugby School	Rev T. N. Hutchinson	3·84	1·14	10	14	49·6	24	27·2	28
DERBYSHIRE.									
Buxton	E. J. Sykes, Esq.	4·73	1·08	15	14	47·5	1	22·6	20
Stoney Middleton	Rev. U. Smith	2·63	1·22	9	6	48·0	2	13·0	20
Brampton St. Thomas	Rev. J. M. Mello	3·09	·89	9	15	50·0	1 & 6	23·0	20
Fernslope, Belper	J. G Jackson, Esq.	2·53	·56	15	14	48·0	1	25·0	21
Spondon	C. E. Jones, Esq.	2·96	·62	24	14	48·0		25·5	29
YORKSHIRE.									
Healey Hall	B. J. Whitaker, Esq.	2·40	·51	12	17	49·0	2	25·0	20
NOTTINGHAMSHIRE.									
Highfield House, Nottingh'm	E. J. Lowe, Esq.	2·36	·54	10	16	54·4	10	25·3	27
Hodsock Priory, Worksop	H. Mellish, Esq.	2·48	·49	15	17	49·7	10	24·7	20
Park Hill, Nottingham	H. F. Johnson, Esq.	2·59	·47	15	13	48·5	1	27·5	20 & 21
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	2·68	·58	24	16	49·9	2	27·7	21
Ashby Magna	Rev. E. Willes	3·41	·68	24	19	49·0	10		
Market Harborough	S. W. Cox, Esq.	3·88	·74	9	18	47·0	9 & 24	24·0	28
Kibworth	T Macauley, Esq.	3·46	·69	15	18				
Town Museum, Leicester	W. J. Harrison, Esq.	3·25	·56	24	19	49·4	1	28·5	21
Belmont Villas, Leicester	H. Billson, Esq.	3·20	·55	24	19	49·0	1	29·0	21
Syston	J. Hames, jun., Esq.	3·74	·46	9	22	45·0	2,3,10,11	28·0	21 & 22
Waltham-le-Wold	E. Ball, Esq.	4·07	·61	23	18	44·0	2 (19	26·0	21
Little Dalby Hall	G. Jones, Esq.	3·39	·58	24	17	47·0	3, 9, 18	25·0	9
Ceston Rectory, Melton	Rev. A. M. Rendell	4·01	·66	15	18	51·0	10	23·0	21
Belvoir Castle	W. Ingram	3·62	·48	25	20	48·0	10	26·0	18, 21, 22, 30
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	3·10	·53	15	14				
Castle Ashby	R. G. Scriven, Esq.	2·88	·54	10	18	50·0	10 & 24	28·0	9
Pitsford	C. A. Markham, Esq.	3·16	·50	24	18	51·0	25	28·0	23 & 30
Kettering	J. Wallis, Esq.	3·08	·44	27	19	50·0	11	29·0	9 & 29
Althorpe	W. F. Jakeman, Esq.	3.24	·64	15	17	49·0	10 & 24	26·0	22 & 29
Northampton	H. Terry, Esq.	2·78	·45	10	16	49·0	5 & 10	28·0	8 & 28
RUTLAND.									
Burley-on-the-Hill	W. Temple, Esq.	3·17	·59	16	17	52·0	7	24·0	9 & 28
West Deyne, Uppingham	Rev. G. H. Mullins	3·51	·68	24	18	49·9	24	28·9	12
Northfields, Stamford	W. Hayes, Esq.	3·46	·64	24	15	55·0	7	26·0	9
Radcliffe Observatory, Oxford	Mr. H. E. Bellamy	2·28	·44	27	16	51·9	10	30·3	12
Spital Cemetery, Carlisle	T. Bell, Esq.	1·64	·40	7	17	48·8	1	22·9	25
Ventnor Hospital	H. Sagar, Esq.	4·09	·60	27	19	53·4	10	31·4	12
Altarnun Vicarage	Rev. G. Tripp	6·10	1·06	11	22	54·0	25	22·0	20

Correspondence.

Dudley Geological Society's Proceedings.—I wish, from the standpoint of a Geological Surveyor, to call the attention of readers of the "Midland Naturalist" to the above-named publication of one of the Societies of the "Midland Union." Two of the papers, by Messrs. Oliver and W. J. Harrison, are on sections on the Midland Railway, and these are not confined to descriptive text, but are accompanied by plates which give measured drawings of the sections on a large scale, and also plans, so that the exact position of any outcrop, &c., can be fixed on the ground when the cutting has been turfed over. This careful record of facts that in all likelihood will soon be hidden up cannot fail to be valued by field-geologists, to whom there can hardly be a more gloomy sight than a large railway-cutting, beautifully smoothed and turfed, of which no record has been kept. I would therefore impress on members of our many provincial societies to note all facts, however trifling they may seem to be; and if any one is in doubt as to how such noting should be done, let him look at the publication referred to. Others of the papers have small plans to show the place of the section or fossils described. Here again is a good example, for the want of precision in such matters has greatly lessened the value of many papers. As the Dudley and Midland Geological Society ceased to publish its proceedings for some years, and has but lately gone into print again, such sure signs of life are welcome, and to none more so than to working Geologists.—W. Whitaker.

Ceratodus at Penarth.—Aust Cliff was for a long time the only British locality which yielded teeth of that remarkable fish the Ceratodus. I found a fragment of a tooth at the Spinney Hill Rhætic Section, near Leicester, in 1873, (it was kindly identified by Mr. W. Davies, of the British Museum,) and Mr. E. Wilson has since got it, near Nottingham. I can now record its occurrence at Penarth, near Cardiff, where it has been found by Mr. Storrie, of the Cardiff Museum.—W. J. H.

Helix Cantiana.—At p. 323, Vol. I., I gave a few notes on the distribution of this species in Britain, placing the county of Northampton in my list of theoretical habitats. Upon receiving the December number of the "Midland Naturalist," I at once turned to the very excellent index, and found that Mr. T. C. Musson, of Nottingham, has recorded (p. 50) its occurrence at Kingscliffe, Northamptonshire. He has kindly sent me specimens. The only adult shell is smaller than usual, white and thin, the latter being an anomalous character, (not uncommon among the Mollusca,) seeing that it occurred on the Great Oolite. I take this opportunity of correcting a mistake I made in giving Littleton, near Evesham, as a habitat. Mr. Slatter tells me it should have been "Evesham, particularly near the ancient walls of the Abbey enclosures," near Littleton being the locality for *Cochlicopa tridens*.—G. Sherriff Tye.

Fertilisation of Orchids.—During the summers of 1874-5, I netted, on Boxley Warren, for purposes of exchange with a friend, for dissection, over 2,000 Lepidoptera. Of these, thirty-five had the anthers of *Orchis pyramidalis* (a common species here,) adhering to their trunks in the manner described and figured in Darwin's "Fertilisation of Orchids." They were of the following species:—Meadow Brown, Ringlet, Small Heath, Small White, Chalk Hill Blue, Common Blue, Burnet Moth. In connection with the last-named species, I had the rare good fortune to witness the whole operation. Seeing a Burnet seated on a large head of *Orchis pyramidalis*, I cautiously approached with pocket lens in one hand

and net in the other. I got close enough to see through the lens the trunk thrust first into one flower, then drawn out with the pair of anthers glued to the trunk with the natural glue of the orchis anther; then thrust into another flower, thus fertilising it with the anthers of the first flower, and then drawn out, now with *two* pairs of anthers glued on. After three pairs of anthers had been attached he became frightened, I suppose at my lens, and flew off. I immediately netted him.—Fred. F. Grensted, Maidstone.

The Rhætic Starfish.—(See Mid. Nat., Vol. I., p. 230.).—After lecturing to the Cardiff Naturalists' Society on Dec. 5th, on "The Origin of Scenery," I went the next day, under the guidance of Mr. Storrie, the indefatigable Curator of the Cardiff Museum, to examine the unrivalled Rhætic section, which stretches along the coast from Penarth to Lavernock. We obtained many beautiful specimens from the bone bed, &c., but I especially wish to note a fine slab, nearly 2ft. square, on which were many specimens of *Cardium Rhæticum*, *Avicula contorta*, and *Pecten valoniensis*, the three characteristic Rhætic shells thus occurring all in a lump as it were. Between the shells I was delighted to recognise several specimens of that lovely star-fish *Ophiolepis Damesii*; the bodies were crushed, but the arms more finely preserved than I have hitherto seen them. This is the first instance on record of the occurrence of this star-fish at Penarth. The slab is now in the Cardiff Museum. In the December Number of "Science Gossip," p. 271, I notice "a star-fish" has been found by Mr. T. Stock, at Aust Cliff, another well-known Rhætic section. It is remarkable that this fossil, of which I found the first specimen near Leicester, in February, 1873, should now turn up at almost every section.—W. Jerome Harrison.

Frost Phenomena.—During the past week the frost and fog together have produced some interesting effects. Hoar-frost is always deposited on that side of an object which faces the wind, so that the direction of the ice-fringes upon the twigs and rails is an accurate register of the air-current. This current must be a very light one, or the rime is shaken off as fast as it accumulates; but, however still the air may seem, there is generally a slight movement in some one direction, and this may readily be ascertained by the direction of the spicules of hoar-frost. On Wednesday morning the ice-fringes all pointed towards the north, and there was a distinct difference in the whiteness of the landscape as seen from the northern and the southern sides. But there was a slight thaw on Wednesday afternoon. The air-current (it was scarcely so much as a breeze) veered round to the south, and on Thursday morning the white side of the landscape was reversed. It continued so till Friday night, when the current again got round to the north without any intermediate thaw, and on Saturday morning all boughs and rails which had not been shaken had a double fringe, one on each side; the northern fringe pointing straight to the breeze, the southern one actually curling round from south to north in a curious and very remarkable manner, not of course from any bending of the individual spicules, but from the unilateral deposition of each fresh spicule, producing the form known to botanists as a "scorpioid cyme," very plainly seen in the flower of the Forget-me-not. So great was the deposit of rime on Saturday morning that many of the spicules were 1½in. in length, and the leafless elms were as thick with winter foliage as if Midsummer had come back again without its chlorophyll—a ghostly, and yet a wonderful and lovely sight.—F. T. Mott, Birstal Hill, Leicester, Dec. 14th.

Ornithology.—I have the pleasure of recording the occurrence of two now comparatively rare birds, namely, the Honey Buzzard, *(Pernis apivorus,)* and the Crested Grebe, *(Podiceps cristatus)* the former captured

at Markfield, within the last fortnight; the latter at Cropston, in the spring of the present year.—J. E. Weatherhead, in the *Leicester Journal*, October 18th, 1878.

Ornithological Notes.—Our Stoke swallows took their departure at the end of September, but for nearly a fortnight afterwards I observed a good many stragglers flying about their usual haunts. On the 9th October I saw a great flock, consisting of many hundreds, congregated about the lower part of Whitley Common. It seemed to be the final muster of the last division of the district, assembled preparatory to their long flight. The day was mild, but very rough and stormy. They were flying high and low, and the surface of the river by Whitley Bridge was quite crowded with them. I still observed a few stragglers on the 10th and 11th, but I saw none after that date. Mr. Phillips, however, tells me that he saw four at Stoke Green on the 26th, and two on the 28th. My old friend Anthony Hunt, now residing at Eastcote, Northamptonshire, was much interested in observing a colony of swallows, who had built their nests under the warm thatch of his house. At the usual time of emigration they all took their departure excepting one pair whose brood were unusually late, and the young birds still unfledged at the time departure. The old birds remained behind in the evident hope of their being able to follow. On the 16th October they were still observed diligently hawking for flies, and feeding their young. The morning of the 17th, however, was raw and foggy. The old birds could stay no longer, and leaving their young in the nest, they disappeared and were seen no more. There are numerous flocks of starlings about the neighbourhood; their numbers decrease when the weather becomes severe, as many of the flocks retreat to the southern countries for a milder climate. A good many of the winter migratory birds have returned to us. I noticed the redwing on the 20th, and the fieldfares appeared about ten days later. In severe seasons the berries of the holly are greedily devoured by these birds. At present, however, many of the hollies in this neighbourhood are still quite bright with the scarlet berries with which they were adorned last Christmas, looking as if they would remain until that season again comes round. On Friday last a fine specimen of the "Glaucous Gull" was hanging at Messrs. Blythe's. It was shot near Flamborough Head. Its colour was whitish grey, not having acquired the pure white on the breast of an old bird. The stretch across the wings was upwards of five feet. It is now in the hands of David Smith to be stuffed and set up, who has also a Tern and a Gull, which were driven inland by stormy weather, and shot in this neighbourhood, and a specimen of the Water Ousel, killed near Coventry. This pretty little bird is common about rapid mountain streams, but not often seen hereabouts.—John Gulson, Coventry, Nov. 5th, 1878.

The Common Viper, (*Vipera hornis.*)—The viper is very common in Devonshire among the gorse bushes, in stony places having a southern aspect; also on the southern slopes of the Cotswold Hills. It appears early in the spring, and is then in a rather torpid state, and can be easily taken or killed. Almost all the vipers that appear early are males, and there appear to be more male vipers than females. The male can readily be distinguished from the female by the darker marks and spots upon its body, and by the gradual tapering of the body from the head to the horny apex of the tail. The marks upon the female are lighter, inclining to a brown colour, and the tail appears as if affixed to the body, which abruptly terminates at the commencement of the tail. In the summer months the viper is not so readily seen, being then more active than the common snake, and escapes or conceals itself in the long grass, bushes, or stones, being a timid animal except when attacked. The favourite food of the viper is the short-tailed field mouse, although frogs

and grass snails are often found in its stomach. The toad which is often found in the stomach of the common snake is not found in the stomach of the viper. The reproductive organs in the male and female differ very much. The male has a soft roe like a fish, the female a string of oblong small bodies—ova—which develope into the shape and size of robins eggs, consisting of yellow matter like the yolk of an egg, before there is any trace of the existence of a young viper. The young viper does not escape from its fine membranous covering until immediately before its passage into the world, when it is lively, active, and well provided with every means of procuring food, and at once leaves the parent. They may be often seen coiled up on a flat stone in a sunny spot when very little longer than when they passed from the old one. You often meet with very young ones early in the spring, during the summer months, and as late as September in the autumn. The young vipers are of a reddish or copper colour; something like that of the common blindworm. —Henry Bird.

Gleanings.

The Midland Naturalist.—The Northampton Natural History Society has set an example which we commend to the consideration of the other societies in "our Union." The committee has decided to present each member (100 in number) with a copy of the "Midland Naturalist" during the present year.

Lyell's Student's Elements of Geology.—A third edition of this popular work has just been issued, revised by Mr. Leonard Lyell, Prof. Judd, and Mr. Etheridge.

Glacial Deposits.—Mr. D. Mackintosh, F.G.S., of Birkenhead, who is well known as an untiring worker at the Drift of the North and North-west of England, has printed a syllabus of a paper he has lately laid before the Royal Society. After some introductory remarks, he treats of the "Boulder-supplying capacity" of (1) Criffel in Kirkcudbrightshire, (2) the Lake District, and (3) the Arenig Mountains. Then the association of flints and lias fossils with Northern Boulders is discussed with many other interesting points. Altogether this "syllabus" is well calculated to whet the appetites of glacialists, and to make them wish for a speedy publication of Mr. Mackintosh's Memoir, either by the Royal or the Geological Society. It is, we believe, illustrated by an elaborate map.

"The Bijou List of British Butterflies," just issued by Mr. H. W. Marsden, of Gloucester, will be welcomed by Lepidopterists as a useful pocket companion. It is based on Dr. Staudinger's List, includes all the "reputed" species, and gives synonymes and authorities. It ought to help to break down the wall of exclusiveness with which the English Lepidopterist has so persistently shut himself in with his "British Butterflies," as if he wished it to be thought that they had "no connection" with those "over the water."

Professor Huxley will lecture in Leicester to the Literary and Philosophical Society on March 24th on "The Structural Characters and the Operations of the Simplest Forms of Living Beings." This subject will be especially interesting in connection with the recent researches of Dr. W. Johnston, F.G.S., the Assistant Officer of Health for Leicester, who traces the infantile diarrhœa, which has been so fearfully prevalent in that town, to the action of various forms of *Bacteria*, Microscopic

organisms, on whose "operations" Professor Huxley will no doubt give full information.

Tablets to Mount Specimens on.—For this purpose wood is generally used, but it is expensive, liable to warp, and difficult to cut true. Various substitutes have been recommended, such as glass covered with paper, &c., but we have lately tried a plan recommended by Prof. Miall, of the Leeds Museum, and found it to answer perfectly. It consists in using pasteboard three-sixteenths of an inch in thickness, or if the tablets are large one-quarter of an inch thick. Any large paper dealer will make pasteboard of any required thickness, and cut it to any size, with perfect accuracy, by a machine. The tablets may be covered with paper of different tints to aid in classification, and the specimens should be fixed on with coaguline.

A Microscopical Society, Literary, and Scientific Institution has been formed at Boston, (mainly by the exertions of Messrs. F. W. Morris and B. J. Stow,) under the presidency of the Rev. G. E. Pattenden, LL.D. The first meeting was held in the Art Room, Shoofriars Hall, Boston, on Monday, the 16th December, when an address was delivered by the President, who said much that was interesting about botany, chemistry, geology, and microscopy. He congratulated the promoters upon their success in the formation of the society. The meeting then resolved itself into a conversazione and exhibition of Natural History and other specimens.

Age of Birds.—Mr. Gulson writes:—"Mr. Miller, of Combe Gardens, has sent me the following amusing account of a venerable Jackdaw, who is one of his *protégés*. He says:—'The bird in question was reared in the spring of 1865, by one of the under-gardeners here. I know the date is correct. I took it from our labour-book, and the young man was only with me one spring—that of 1865, in which the daw was reared. The age of the bird is now, calculating from June, 1865, 13½ years. Jack was left to the gardeners as a sort of legacy. I took to the bird and fed it with crumbs from my window. He came regularly for his food. For several years this pet mated with the wild birds. One he selected, and I believe stuck to all through; I know it from the drooping habit of its wings. Their nest was in a hole in an ash tree close by. Many a lump of bread did Jack carry away from my window to feed his family year after year in that hole. Besides his mate, Jack has a great number of relations and followers or friends, who come to my window in hard times. Jack is blind of one eye, the result no doubt of defending his nest in the hollow tree. He also has a crooked leg, but, considering his age, he is in fairly good plumage, and comes for his soft bread regularly. He does not like crust.' Considering the enormous number of young birds which are reared every year, the death-rate among the feathered tribes must necessarily be a very high one, and few can survive to the good old age of the bird mentioned above. During a hard winter many sorts of birds find subsistence difficult, and their number becomes greatly reduced, but a few mild seasons and abundant food soon restore about their average number."

Reports of Societies.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY.—November 27th.—Mr. G. S. Dunn, B.A., read a paper on the "Human Ear." In the course of it he stated that since the so-called Corti's rods are absent in birds, they could not be the means whereby musical tunes are distinguished; but that

probably the membrane in which they are situated fulfils this office. December 3rd.—A party of the members visited the brass-founding establishment of Messrs. W. Tonks and Sons. Amongst the processes inspected were those of modelling the patterns, moulding, casting, tube-making, brazing, polishing, stamping, making brass-headed nails, pickling, lacquering, and tool-making. December 11th.—Mr. J. W. Pickering read a paper on "The Autotype Process of Photography," which he described as the reproduction of an artist's work in monochrome by the natural forces of light or actinism and chemical affinity, the materials employed being those of the artist's own palette. Mr. Pickering gave a short history of photography, from its introduction in 1839 by Mr. Mungo Ponton, who announced it as "a process of producing images by the action of light on paper which had been impregnated with a solution of bichromate of potash," to its perfection in 1864 by Mr. Wilson Swan, of Newcastle, who, by temporarily transferring the film to another surface, and washing it from its under-surface, succeeded in bringing out the half-tones, and thus rendered the process so complete that autotype pictures are incapable of being affected by the atmosphere. The lecture was illustrated by a practical demonstration of the process, and an exhibition of a fine series of autotype copies of works of art, lent for the occasion by the Autotype Company.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—MICROSCOPICAL GENERAL MEETING.—November 19th.—Mr. J. Levick exhibited *Epistylis grandis*, *Zoothamnium arbuscula*, and *Carchesium polypinum*, all fed upon carmine. Mr. H. E. Forrest exhibited and described a simple and easy method of drawing objects under the microscope, of which a brief description will be found under the head "Microscopy," at page 18. GENERAL MEETING.—December 3rd.—Mr. W. Southall exhibited a spike of fruit of *Gunnera scabra*, native of Chili. Mr. W. G. Blatch read a paper on "Midland Entomology," which will be printed in the "Midland Naturalist." BIOLOGICAL SECTION.—December 10th.—Mr. H. E. Forrest read a paper on "the History and Development of *Zoothamnium arbuscula* and some other Vorticellidæ," which will appear in a future number. Among the specimens exhibited were the rare beetle *Prionus coriarius*, occasionally found in the south of England, and of which Mr. W. G. Blatch now contributed the male taken at Aston, in July last; and marine organisms, shown in the microscope, by Mr. T. Bolton, and identified by Professor E. Ray Lankester as the Trochosphere phase or larvæ of the Polyzoon, *Alcyonidium hirsutum*. In reference to these, Professor Lankester writes, "These larvæ are very interesting objects for study. They have the form of a compressed circular disc, or rather of two discs placed one on the other. The larger one is bounded by a circlet of powerful cilia, the 'architroch' or 'primitive ciliated band,' which appears under one form or another in so many invertebrate larvæ. On the upper surface of this ciliated disc is carried the mouth, which leads into a very remarkable protrusible pharynx. The rudimentary digestive cavity is clearly seen in specimens slightly compressed by the cover-glass. The ciliated band is what gives rise later to the tentacles of the Polyzoon. These larvæ have never been well figured in England. Last year M. Jules Barrois published a large work on the subject at Lille, with many plates."

BURTON NATURAL HISTORY AND ARCHÆOLOGICAL SOCIETY.—December 10th.—Mr. Ford read an interesting paper on "The Gypsum Beds of the Triassic Marls of the Neighbourhood." He pointed out that gypsum is usually considered to be a chemically-formed rock, deposited in the waters of a lake or inland sea by evaporation, in the same manner as rock salt. But no instances can be pointed out where beds of gypsum are forming at the present day in this manner; and it seems more likely that they are the result of the mutual decomposition of carbonate of lime and some sulphide or sulphate. The resulting sulphate of lime (gypsum) being soluble in water would be carried in solution through the rocks until it arrived at the water level, where it crystallised out, filling fissures, &c. Gypsum can be traced from Chellaston, by Aston, to Thrumpton, Gotham, Beacon Hill, Newark, and Bingham. It is also worked near Carlisle, and in the other direction at Fauld and Chartley. A thin vein, about 1½ inches across, occurs in the bed of the Ouse beyond Goole. The

plaster marls extend all under Needwood Forest, and crop out in the valleys of the Trent and Dove. At Shobnall, crystallised gypsum or selenite occurs in fine veins. The superior quality of the Burton beer is owing to the amount of gypsum dissolved in the well waters. Distant brewers are now regularly getting this material supplied in sacks, to make the water they brew with somewhat similar to the Burton water. The author concluded by proposing an excursion in the spring to Tutbury, the plaster quarries at Fauld, &c., and returning from Sudbury.

CHELTENHAM NATURAL SCIENCE SOCIETY.—November 21st.—The second evening meeting of the Society for this session was held at the Corn Exchange. Dr. Wright, after having briefly returned thanks to the Society for having re-elected him as President for the present session, introduced the subject for the evening—an address on the geographical distribution of the existing races of plants and animals, by Mr. H. J. Elwes, F.Z.S., &c., who was well known to the scientific public as a most energetic traveller, and as a careful collector not only of objects of Natural History but also of facts bearing upon physical geography. An abstract of the address and the discussion thereon will be found at page 9.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.—NATURAL SCIENCE SECTION.—November 29th.—Lecture on "Trees," by the Rev. G. E. C. Casey, M.A., F.G.S., illustrated by diagrams and photographs. December 13th.—"The Animals of Australia," illustrated by photographic slides from life, by A. H. Scott White, Esq., B.A., B.Sc., F.G.S.

NOTTINGHAM NATURALISTS' SOCIETY.—Meetings have been held as follows:—November 20th, paper on "Insect Architecture," by Mr. H. Johnson. December 4th, exhibition of prize collections of Natural History objects. Prizes were awarded as follows:—Botany: 1st prize, Mr. H. Johnson; 2nd, Miss Cross. Conchology: 1st prize, Mr. C. T. Musson. Entomology: 1st prize, Mr. W. J. Rawson; second Mr. R. Wix. Geology: 1st prize, Mr. C. T. Musson. Microscopical objects mounted: Mr. Thornton. December 18th, paper on "Oysters and their Culture," by Mr. B. S. Dodd.

PETERBOROUGH NATURAL HISTORY AND SCIENTIFIC SOCIETY.—November 6th.—The President (E. Wheeler, Esq.,) read a paper on "Climbing Plants," mainly based on Dr. Darwin's work on that subject. The parts of plants that climb and how they climb were described. The most common and the most interesting plants that twine merely or that have irritable leaves or tendrils were also described, and the special adaptability of each climber to its work was noticed. A number of pen and ink sketches were exhibited to explain the various organs mentioned. November 25th.—Mr. W. Wakeford gave an address on oxygen and hydrogen. Mr. Bodger exhibited geological specimens, consisting of plants from the coal shales; shells and corals from the Silurian Rocks; and a few Oolitic plants, of rare occurrence, from the Gristhorpe beds; together with several specimens of various iron-ores. December 10th.—The Rev. W. Katterns read a paper on "The Food and Organisation of Plants." The paper, which is an introduction to a series upon the growth of vegetation, is the outcome of experiments made since 1873. A brief *resumé* would fail to state explicitly the author's views, which, it may be stated, differ in several particulars from those usually held on the subject. It was decided, owing to the importance of the paper, that it should be printed at the expense of the Society, for exclusive circulation amongst the members. The Secretary (Mr. J. W. Bodger,) read a paper on the substances he had obtained from garden soil, which, at the suggestion of Mr. Katterns, he had analysed. An animated discussion took place, which lasted so long that a special meeting had to be called for the further discussion of this paper. Mr. Bodger exhibited a number of seaweeds and corallines which he had received as a present for the Society's Museum.

RUGBY SCHOOL NATURAL HISTORY SOCIETY.—December 7th.—H. V. Weeisse (O.R.) read a paper on the "Electric Light, and the Probabilities of its general Substitution for Gas." He argued that this was improbable.—T. B. Oldham (M.) exhibited a specimen of *Am. Capricornus* (named by R. Etheridge, Esq.) from a blue clay underlying a brown conglomerate, hitherto regarded as the base of the Middle Lias at Crick. He then read a summary of his paper on the "Geology of Rugby," which won the Society's prize.—The President read a paper on "The Growth, History, and chief Collectors of the Society's Entomological Collection."—The Secretary read a paper on "Tripontium," now Cave's Hill, an Antonine town on the Watling Street, near Rugby.—Mr. Bloxam discussed the paper.—R. D. Oldham (O.R.) pointed out the importance of the *Am. Capricornus* in drawing the line of demarcation between Middle and Lower Lias. This is to be done by Palæontology. The Geological Survey, when here, seem to have adopted a lithological basis of demarcation. Their line accordingly is wrong; the truth is that there is no marked line.—The meeting then terminated. This was the last meeting of the year.

SMALL HEATH LITERARY AND SCIENTIFIC SOCIETY.—The third lecture of the series for the present session was delivered in the Congregational Schoolroom, Coventry Road, on Monday, December 9th, by Mr. J. W. Oliver, (Professor of Geology and Botany at the Birmingham and Midland Institute,) on "The Story of the Rocks." The subject was treated in a popular and interesting style, and was illustrated by a number of diagrams and specimens.—At the ordinary meeting of the Society, held in the Board Sceools, Jenkins Street, on December 17th, a debate took place on the question, "That we are now in possession of sufficient evidence to enable us conclusively to accept the theory of evolution." The affirmative was taken by Councillor Lawson Tait, who was to have been supported by Dr. John Lloyd, but the latter gentleman was unable to be present. Mr. Tait concisely set forth the main claims of the Evolutionary Philosophy, after which the Rev. Charles Joseph and Mr. W. J. Bain delivered speeches in the negative. The result of the voting of the members showed a majority of six in favour of the negative, but, on the vote of members and visitors together being taken, the majority was very much larger. The debate was a very spirited one, and the attendance larger than at any previous meeting.

STROUD NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.—December 10th.—Major Fisher gave a very interesting account of "Modern Falconry," illustrating the subject with some excellent sketches and two living specimens of falcons.

Answers to Correspondents.

SCIENTIFIC BOOKWORM.—Foreign books of all kinds may be obtained through Mr. D. Nutt, 270, Strand, London, W.C., or from Williams and Norgate, 14, Henrietta Street, Covent Garden. The latter firm has lately published catalogues, which they will send on application. For English and foreign science books consult the "Book Circulars" of Mr. W. Wesley, 28, Essex Street, Strand. For English science books consult the catalogues of Mr. Wheldon, 58, Great Queen Street, Lincoln's Inn Fields; Messrs. Reeves and Turner, 196, Strand; Mr. Quaritch, Piccadilly; or W. H. Smith and Son, 186, Strand. All these will send catalogues on application, and expensive books may often be obtained in this way at less than half price.

All communications to be addressed, The Editors of the MIDLAND NATURALIST, Midland Counties Herald Office, Birmingham.

PASSAGES FROM POPULAR LECTURES.

BY F. T. MOTT, F.R.G.S.

II.—THE SCALE OF BEING.

When a human baby opens its dazed eyes upon this world, what it first perceives is simply light and darkness. It distinguishes neither forms nor colours. It is mentally in the condition of the oyster, the starfish, the worm, and other animals of low type. But a few weeks of exercise and experience bring it to its second stage. It perceives the outlines of things. It recognises differences of sound and of colour, and knows its mother's voice and face among a thousand. It has reached the condition of a vertebrate animal—a lamb or a sucking pig. But it does not stop here; it is only in the bud yet, and has a great deal of capacity still to be developed.

In a few months it knows a tree from a steam engine, and when it sees the picture of a cow it will say "moo!" But it calls every horned creature a cow, and everything with leaves and branches a tree. It is a human child, but a very ignorant one; nevertheless, it is already learning the elements of science, of which a very large part is simply the knowledge of one thing from another, and of the connections between one thing and another; the perception of differences and likenesses, of causes and effects, first among visible objects, and then among invisible forces.

The more we have learned to comprehend the real differences by which objects are separated from each other, and the real likenesses by which they are connected together, the further we are from babyhood. We are accustomed to reckon a man's age by the number of years he has lived. A better standard would be the number of ideas he has got. The use of lectures and classes is to give us a few more ideas than we had before—to add a few degrees to our real age. The kind of ideas does not very much matter so that they are new to us and true in themselves. They are all useful, all add a little to our age, taking us a few steps further from the cradle and nearer to heaven. Let us endeavour to gather up a few ideas—there may be a new one among them here and there, new to some of us at least—about those inhabitants of the world which have no speech and little motion, but to which we owe the whole of our physical life, and at least one-half of its enjoyments.

We call these creatures Plants. We class them together as the vegetable kingdom, perceiving that there is a mineral kingdom below them, and an animal kingdom above them; and we call the study of this class of creatures Botany.

What do we mean when we say that the mineral kingdom is below them and the animal kingdom above them? We don't use these words *below* and *above* in reference to height, that is, to distance from the centre of the earth, as when we say that a man's nose is below his eyes and above his chin. The mineral kingdom is not in this sense altogether below the vegetable, for the great mountain ranges of the world rise up far above all trace or possibility of vegetation. We use them not in reference to a scale of feet and inches, but in reference to a

scale of *capabilities*. We say that plants are higher than minerals, because they have more varied and more complex capacities, they can *do* more. And, for the same reason, we say that animals are higher than plants.

A mineral, such as a piece of iron, has a definite form, a definite colour, it will conduct heat and electricity in definite degrees, and it will attract oxygen if it comes near it in the presence of water. But a plant has nearly all the capacities of a mineral, and many more besides. It feeds, and breathes, and grows, and reproduces its kind, and has a multitude of internal motions and operations going on among its tissues. It *does* an immense number of things which the piece of iron cannot do. The difference between them is wider than the difference between a watch and a stone, but it is something of the same kind.

But, if the plant is higher in the scale of being than the mineral, it is a great deal lower than the animal. A dog not only feeds, and breathes, and grows, and reproduces its kind, but can move about from place to place rapidly and easily; and has a voice, and eyes to see with, and ears to take in sound, and a brain in which ideas and passions are developed. A plant has none of these capacities.

When we look at the whole material contents of this world, we find that there is one marked and striking difference which divides them into two great classes—the organic and the inorganic. In the first of these divisions every object has a variety of parts, differing from each other, and each part has certain definite work to do in connection with a common purpose. We call these parts organs. In a dog there are legs for running, a nose for smelling, teeth for eating, and a tail to wag. In a tree there are roots to suck up moisture, a stem to support the boughs, boughs to carry the leaves, leaves to spread out the sap in the sunshine, flowers to produce seed. But in a piece of iron there are no organs. It is a mass of grains or fibres, all alike, and each doing the same work. So is a stone, so is water, so is the air. All these together we call the inorganic world; animals and vegetables make up the organic world. *Life* is said also to be a special characteristic of creatures which have definite organs. It may be so; but it is not quite proved that life is entirely absent from inorganic objects. In crystallisation we have a phenomenon in which some of the elementary characters of life make their appearance, and in which organic differentiation of parts seems to be foreshadowed. Who shall say whether the vegetative force, which builds an oak out of an acorn, is not of the same nature as that which builds a "silver tree" out of a chemical solution?

MIDLAND ENTOMOLOGY: ENQUIRIES AND SUGGESTIONS.

BY W. G. BLATCH.

Is any progress being made in the study of Entomology in the Midland Counties? Are Entomologists really "few and far between" in central England; or are they, like many of their favourite insects, too unobtrusive in their habits? Can anything be done to develop and foster Entomological tastes in our local Societies?

These three questions are a digest of a great number of enquiries which I have heard made during the last few months, and they seem to indicate that, in at least one leading Society in the "Midland Union," Entomology is about to assume a new and more hopeful phase. This is very gratifying; for although I do not admit that this science is neglected quite to the extent some would have us believe, I am only too well aware that it does not receive the attention it deserves; but, in truth, the last remark applies equally to the whole of the British Islands as to the Midland Counties. From all parts we hear the same lament that Entomology is too much neglected. It seems to flourish most in the south and north, whilst in the east and west it is very little regarded. The English and Scotch, respectively, are most attached to this pursuit, the Irish being a long way behind both, and the Welsh just nowhere at all! But, however interesting it might be to prosecute an enquiry into this broader subject, our attention for the present must be concentrated upon the narrower theme of "Midland Entomology."

How it has come about I am unable to explain, but certain it is that, entomologically speaking, the Midland Counties have acquired a bad name. In the "Entomologists' Intelligencer" for 1857 frequent allusion is made to the alleged barrenness of the Midland fauna—especially as regards insects—and one writer, in giving counsel to Coleopterists, says: "In a general sense, therefore, *let the Midland Counties be shunned by all as they would the plague!*" The italics are in the original, and are used, I imagine, to intensify the meaning, and to impress upon any rash adventurer in search of Midland insects the utter hopelessness of his design. I recollect that, upon my advent into this district, now eleven years ago, I was told that I might choose some other hobby than Entomology, "for there are no insects in the Midlands except *Nebria brevicollis*, *Pieris rapæ*, *Panorpa communis*, *Musca domestica*, and a few others equally common!" I was certainly very much impressed, though not depressed, by this information; for, as my object was to make myself acquainted with the insects of the locality, and not simply and primarily to acquire a "complete collection," I was not deterred from prosecuting my researches as far as my limited time and abilities allowed. With what result? Why, during the very first season I found, almost without effort, so many "good things" that my faith in the written and oral counsels referred to was greatly shaken, if not wholly destroyed, and the conclusion I came to was that this district would prove as interesting and productive (in a general way) as any other, if properly worked. Subsequent experience, and a comparison of notes with a few close but unobtrusive observers, have confirmed the justness of this view.

It would occupy too much space here to give a list of the rarer species of insects captured in the district. For Lepidoptera I must refer enquirers to the Transactions (Vols. I. and II.) of the Birmingham Natural History and Microscopical Society. The lists there given, however, only apply to the immediate neighbourhood of Birmingham, and must not be taken as representing the wealth of the Midlands in the particular order

selected. To the lists as limited there are many additions ready to be made; and if they were opened so as to include the wider area, they would expand enormously. As they stand, however, indicative of what has been accomplished, they are suggestive of much more to be done before the knowledge to be obtained of even the Butterflies and Moths of our suburban woods, lanes, and fields is exhausted.

I have no catalogue of Midland Coleoptera to refer to, but I can testify that better things are to be found amongst us than *Nebria brevicollis* and *Pterostichus madidus*, and that the sterility said to prevail here exists only in the imagination of those who draw conclusions from insufficient premises. Amongst the species of Coleoptera taken by myself, I may mention that I have found at Knowle, nearly in the middle of the most midland of the Midland Counties, specimens of the rare *Trachys troglodytes*, whilst *Encephalus complicans*, *Orobitis cyaneus*, *Callidium alni*, &c., have been frequently found by myself in the same locality. It is worth mention here that a fine specimen of the rare *Prionus coriarius* has been presented to me by Mr. Thos. Taylor, whose nephew found it last July crawling on a wall at Aston-juxta-Birmingham. A few hours' hunting on Cannock Chase produced *Carabus nitens*, *C. arvensis*, *Nebria livida*, *Miscodera arctica*, *Pterostichus lepidus*, *Silpha opaca*, and several other uncommon species. Not far from Burton-upon-Trent Mr. Harris, of that place, discovered the rare and curious *Macronychus quadrituberculatus*, a species found nowhere else in England. Surely a district in which such insects as these are to be found cannot be considered unworthy of further examination. The fact is, as I have before hinted, our knowledge of Midland insects is in a very imperfect state; and, because little is known, it has been rather hastily and unwarrantably concluded that there is little to know. I do not claim for the Midlands the insect riches of the east and south, but I do say that a great deal more may be discovered here, with a little effort, than has ever been dreamed of. The habits of great numbers of our insects are so obscure, and the laws and conditions which regulate their appearance from time to time so little understood, that it is only by close and systematic observation, extending over a number of years, that the insect inhabitants of any particular locality can be ascertained. Practically the Entomology of an extensive district like our own is inexhaustible, something "new" or "new to the district" being constantly turned up, and it may be taken as an axiom that *the more closely a locality is examined the more productive will it be found to be.*

Having thus, to some extent, cleared the Midland district from the aspersions cast upon it, and shown that it presents a not altogether unpromising field for Entomological energy and enterprise, we may now fairly ask what is being done towards developing its insect riches.

It must at once be admitted that, compared with the extent of the field and the vast number and variety of its insect denizens, the work is sadly neglected. The important and extremely interesting orders *Hymenoptera* and *Diptera* are scarcely touched, whilst most of the lesser orders are almost as much disregarded as if they had no existence. The

order Lepidoptera appears to be the favourite—about fifty persons (probably there are many more) in Birmingham alone (to my knowledge) paying it more or less attention. Only a very few of these, however, care for more than the mere capture and possession of the insects, the majority not troubling themselves about their natural history, and not contributing anything to the general store of information respecting them. A few keen and trustworthy observers are, however, to be found amongst the number; the names of some of them (Dr. Jordan, *e.g.*) being known wherever Entomology is studied. The order Coleoptera is now receiving more attention than heretofore, several of our best Entomologists being at work upon it. The progress made, however, although appreciable, is not so great as could be desired. Two very good reasons (as affecting existing workers) may be given for this, viz., because the observers, being, as a rule, widely separated from each other, are unable to work much in unison; and because the time, and therefore the opportunities, at their disposal for Entomological purposes are extremely limited.

We cannot, I fear, claim that a very decided affirmative has been given to the first question at the beginning of this paper, but even a feeble response may greatly encourage an ardent lover, and all lovers of insects will rejoice to know that some, even if little, progress is certainly being made in our knowledge of Midland Entomology.

In reply to the second question, as to the number, distribution, and character of the Entomologists of the district, there is not much to be added to what has already been said. The number of real workers is comparatively small, they are very much isolated, and, probably the natural result of their separation from each other, they are characterised by great unobtrusiveness. It is to be hoped that more of the members of our societies will enter upon this fascinating study, and that those who are already far advanced in the science may be induced to "come out" of their seclusion, and make known their discoveries for the benefit of their less accomplished co-workers. If our Entomologists could by any means be brought into easy communication, and prevailed upon to unite in systematic action—meeting together occasionally, if possible, for mutual intercourse and comparison of notes—I feel quite sure that great and rapid strides would be made in their favourite pursuit, and that the Midland Counties would soon become famous in the annals of Entomology.

It now remains to reply to the third and last question—Whether anything can be done to develop and foster Entomological tastes in our societies? All seem to be agreed that it is desirable to encourage the study of Entomology; but opinions will no doubt differ as to the means by which that end should be sought. That this science is neglected by our members generally has already been shown, and it seems to me that the first step towards applying any remedy is to find out, if possible, the cause of the neglect complained of. At first sight it is not easy to understand why Botany, Geology, and Microscopy should attract a larger number of observers, and be considered more suitable subjects for study than Entomology. Such, however, seems to be the case in most of our

societies, and I think it will not be very difficult, after a little closer examination, to show that there are sufficient reasons for the preference. Some of these are undoubtedly beyond our power to obviate, but there are others that, to some extent, admit of being practically dealt with.

The superficial but general idea "that insects are unworthy of notice because they are so common and insignificant, and that the study of flies and beetles is consequently too childish an occupation for any but schoolboys," is not deserving of the trouble of refutation, although it must be admitted that it has often had a deterrent effect; for few persons are so thoroughly case-hardened that they can persistently withstand the shafts of ridicule—the ridicule, moreover, of their friends.

That Entomologists should be subjected to derision is neither wonderful nor singular; every specialist must expect to receive his share. It is as inseparable from those peculiar people who *will* deviate from the beaten track as shadow is from substance. I think it should be considered complimentary rather than derogatory, and that instead of shrinking from it we ought to welcome it as indicating, in proportion to its intensity, the importance of our special pursuit, and the strength of our moral courage.

The real difficulties are of a more serious nature, two or three of which may be discussed. First there is the *vastness of the subject*. It is no joke to face our myriad insect tribes and their myriads of Latin and Latinish names. Bruin amongst the bees, and the proverbial hornet's nest, are as nothing to it. Who, unless moved by an enthusiasm that blinds to contingencies, would dare to begin the attack? The immense number of our species of insects is in itself enough to stagger any ordinary tyro; but the classification and nomenclature by which they are fenced about form a perfect *chevaux de frise* before which the boldest quails. We cannot, of course, alter this state of things. Additions will continue to be made to the number of our known insects, and the anomalies of nomenclature and classification, the natural outgrowth (an excrescence if you will) of the science, will certainly not diminish as new workers appear. The best way of avoiding this difficulty is not to see it. The would-be Entomologist must not think of the number of insects to be known, and must resolutely shut his eyes upon the musty mass of synonymy. His course will then be easy, and his progress rapid. He will begin with a single insect, a separate genus, or a distinct order, and, as his interest is excited, and his knowledge extended, the obstacles he feared at the outset will fade away, becoming small by degrees and beautifully less.

Having advanced thus far, the student would be none the worse for a little encouragement from the Society of which he happened to be a member. I offer it as a suggestion whether our Societies might not be of much use in developing original research by offering to publish monographs of obscure genera, descriptions of new and little known species, or any other similar work, the result of independent observations. Special subjects, beginning with insects hurtful or beneficial to man, might be recommended for study, and original memoirs invited; these could be examined by a competent Committee, and the best selected for publication.

By these means the science of Entomology would be advanced. Entomologists—both old hands and incipients—would be benefited, and our Societies would crown themselves with honour.

Having dealt with one of the main causes that operate to deter persons from entering upon the pursuit of Entomology, we may proceed to consider another of even greater importance, viz., *the want of reliable and easily accessible works descriptive of the species of insects belonging to the several orders.* With few exceptions the records of Entomological research are scattered about and hidden away in a vast mass of literature, consisting of transactions of the various learned Societies, (English and foreign,) pamphlets, magazines, &c., and are inaccessible to the ordinary student. If it is desired to identify any particular insect, or to find out what is known of its natural history, it will probably be necessary to consult a dozen different works—English, French, German, and Latin—gleaning a little information from each of them. The Botanist and Geologist are better off than the Entomologist in the matter of text-books, and this doubtless accounts in great measure for the fact previously alluded to, that those subjects are commonly preferred to the one under consideration. Our Societies could do much to remove this difficulty by purchasing a copy of every good monograph published, and by laying themselves out to secure sets of all the scientific societies' publications—generally expensive and beyond the means of individuals—instead of frittering away their funds in buying the cheaper books which nearly everyone could afford to obtain for himself.

Two very effectual means of fostering Entomological tastes amongst us would be the formation of collections and the issue of lists, as complete as possible, and to be added to from time to time, of Midland Insects, with notes as to localities, dates, and other particulars. Every society should have not only a general collection of insects, but a collection of the insects of their particular district. These, together with the local lists, would form a good base of operations, and afford the requisite facilities for gauging his own work, to any one who might desire to enter upon the study, and would, besides, be extremely valuable to the more advanced workers.

A suggestion has been made that a new class of constituents should be added to our societies by the admission of youths with a taste for Natural History, under the name of Associates. If that idea should be acted upon, it might be worth consideration (bear in mind that it is principally to the young we must look for our expected crop of Entomologists) whether small money or book prizes might not be offered for Entomological work, either in the form of original papers, general collections of insects, or collections illustrative of particular orders or families.

No doubt there are many other methods by which the taste for Entomology could be extended, and very much more could, of course, be said in reference to the few rather crude hints I have ventured to throw out. This paper, however, is not intended to be more than merely suggestive, and the aim of the writer will have been accomplished if it conduces in the remotest degree to greater attention being paid in and by our societies to the interesting subject of "Midland Entomology."

MOSS HABITATS.

BY JAMES E. BAGNALL.

(Continued from Vol. I., page 320.)

A newly-ploughed field, or, better still, one that has lain fallow for some little time, although presenting few charms for the general observer of Nature, will be spots to which the would-be bryologist must give his particular attention, and during those dreary months which intervene between October and April he will, if in any way an enthusiast, find plenty of work for his microscope.

The mosses to be found in such habitats are usually the simplest, from a pretty point of view the least noticeable, and the shortest lived of any he may study, and when preserved for the herbarium are, perhaps, the most disappointing, looking very often more like dried masses of mud than aught else, still these earth mosses or *Phascei* are worthy of his attention. The plan I adopt with these minuter species is not only to dry some of them with their underlying mud, but also to mount a few specimens of each on the ordinary 3in. by 1in. slips of glass, in glycerine jelly, for my cabinet, and very pretty objects many of them make when thus prepared.

The older Botanists placed all the *Phascei* in the genus *Phascum*, but modern Botanists, seeing that the group was a very heterogeneous one, have split these *Phascei* into several genera, such as *Pleuridium*, *Phascum*, *Sphærangium*, *Ephemerum*, *Archidium*, &c. I shall speak only of those that I have myself found most frequent.

Besides these I also find in like habitats such mosses as *Pottia minutula*, *Funaria fascicularis*, and *Tortula unguiculata*.

The *Phascei* usually occur in scattered patches, and, being minute, require the constant use of the field lens, and rather close searching in many cases. Taking their general characteristics they may readily be known by their small bladder-like capsules, usually more or less concealed by the surrounding leaves, the fruit-stalk being very short in most species, and by the absence of a true lid or operculum [Plate IV., Fig. 11.]*

Pleuridium subulatum is a not unfrequent inhabitant of sandy and marly fields. It may also often be found in great abundance in the cleared spaces of woods, and is in good condition about April; will be found in yellowish patches, often rather extensive; the capsule is oval, and immersed in the awl-shaped bristly-looking leaves; the leaves are rigid, and have a broad nerve, which scarcely extends to the tip of the leaf; the uppermost leaves are longer than the lower ones, and much narrower.

Phascum cuspidatum is a frequent denizen of sandy fields, and occurs in small scattered light-green patches. The leaves are large for the size of the plant, are concave, oblong lance-shaped, and somewhat keeled, with the margin turned over towards the under side; the nerve projects beyond the leaf-tip, forming a short cusp-like point; the capsule is roundish and more or less hidden among the leaves; leaf-cells quadrate, slightly papillose; spores slightly roughened.

* All the references in this Article are to Plate IV., Vol. I., facing page 193.

Sphærangium muticum is much more rare, occurs in sandy and marly fields in dark-green or brownish tufts, looking to the unassisted eye like small tufts of minute bulbs. It is more minute than the last, and has broad, roundish, concave leaves, not keeled, but rounded on the back, the nerve rarely reaching the leaf-tip, and the leaves are usually slightly toothed in their upper part, and have plane margins; the capsule is round, and quite hidden among the upper leaves; the spores pale, roundish, smooth; leaf-cells large. In good fruit, March or April.

Ephemerum serratum occurs most abundantly in marly fields, but may also be found in sandy ones, and looks to the unassisted eye like a little patch of green conferva; the lens will, however, show the small reddish-brown sessile capsules, surrounded by the narrow lance-shaped slightly toothed leaves; the leaves are nerveless, light-green, with transparent longish leaf cells; spores yellow, globose, slightly roughened. In this moss the protonema [Plate IV., Fig. 3 *a*] continues throughout the lifetime of the moss; and hence, in a single specimen under the microscope, the life-history of a moss may often be seen—the protonema, young buds, perfect plant, and capsule bearing the spores. Fruit, October to April.

Archidium phascoides I have rarely found in fields, but it does occur occasionally in marly fallow fields; it is very minute, and requires close searching, and as the capsule is very small may often be passed over as a mere barren tuft of *Dicranella varia*. It may, however, be known by its round capsules and strongly nerved leaves, and by its giving off lateral, sterile, whip-shaped shoots from the fertile stem.

Pottia minutula I find not unfrequent in marly fields, in small, brownish-green tufts. The stem is very short, the leaves oblong, lance-shaped, tapering to the point, slightly overlapping and spreading when moist, erect when dry, margin much recurved; capsule on a short fruit-stalk; mouth naked, *i.e.*, without a fringe; lid large, conical; leaf-cells quadrate.

Tortula unguiculata occurs in every sort of soil, is very variable, and often puzzling. Sometimes great glaucous green tufts of this moss will be seen without a vestige of fruit, at other times fruiting specimens will be abundant. The leaves are oblong, lance-shaped, blunt, with a minute point formed by the projecting nerve, margin curved towards the under side; leaf-cells dense and quadrate in the upper part, large and transparent below; leaves much twisted when dry; capsule erect, cylindrical; fringe of thirty-two twisted teeth; lid awl-shaped.

Funaria fascicularis occurs in sandy fields, in scattered tufts, and will be readily known by its widely lance-shaped toothed leaves, with large leaf-cells, pear-shaped capsule, convex lid, and inflated calyptra, (Plate IV., Fig. 17,) no peristome or fringe.

Many of our heath-lands are being rapidly reclaimed; and vexatious as it may be to the Botanist to see the haunts of some of his favourites destroyed, he will, if wise, feel that it is far better that these lands should be made the means of employing labour and adding to the wealth of the country, rather than allowed to lie idle, the mere producers of weeds.

But, in the neighbourhood of these reclaimed wastes, the borders of many of the fields, and the waysides of the lanes will still retain much of their heath-like character, and in such localities I have found the mosses of our heath-lands fairly represented. The mosses that I shall characterise as heath-mosses are *Ceratodon purpureus*, *Campylopus fragilis*, *Bryum nutans*, *Funaria hygrometrica*, *Polytrichum piliferum*, and *Hypnum cupressiforme*. These mosses, although abundant on heath-lands in Warwickshire, are by no means confined to such localities.

Ceratodon purpureus will be found abundantly on heathy waysides in good fruit about the middle of May, and will be found forming large dull-green patches, the purple fruit-stalk and fruit giving quite a character to the locality. The leaves are lance-shaped, with reflexed entire margins keeled on the back; the capsules oval, slightly curved, furrowed when dry, and slightly strumose at the base, (Plate IV., Fig. 13 *b*;) lid conical, and fringe of sixteen teeth united by transverse bars. The fringe of this species forms a beautiful object for the microscope.

Funaria hygrometrica will be found very abundantly in like places, more especially where the soil has been burnt, forming large yellowish-green patches, and when abundant has a very striking appearance. The leaves are large, very concave; the leaf-cells large, hexagonal; capsule curved, somewhat pear-shaped, purple, and furrowed when ripe, surmounted by a beautifully marked plane-convex lid; the peristome or fringe double, the outer fringe being formed of sixteen beautifully marked reddish teeth, the inner of sixteen yellowish teeth; annulus large.

Campylopus fragilis, although abundant on our Sutton Park heath-lands, is by no means common on the heathy waysides; it will be found forming dense yellowish-green patches, the very fragile leaves being scattered abundantly over the patches; the leaves are lance-shaped, the nerve is broad, forming the greater part of the leaf, and composed of small quadrate cells. The cells of the leaf-base are large and transparent. The fruit is rare, and is usually found in autumn.

Bryum nutans is a very abundant moss on damp heath-lands. I also find it in very dense masses on thatched roofs. It occurs in large dark-green tufts, the lower leaves are oval, lance-shaped, entire, the upper ones are longer, narrowly lance-shaped and toothed; the nerve scarcely reaches the tip of the leaf; leaf-cells hexagonal, elongated; fruit-stalk reddish; capsule pendulous, somewhat pear-shaped; lid convex, with a small point; fringe double. Fruit in May or June.

Polytrichum piliferum will be found abundantly on many heathy waysides in loose dark-green tufts, and may be readily distinguished by its large thick lance-shaped leaves, sheathing at the base, and terminated by a white hair-like toothed point; the capsules are large, four-angled, with a distinct swelling just below the base of the capsule, called the apophysis; the fringe is formed of sixty-four teeth, which curve over the membranous process closing the mouth of the capsule, (the diaphragm, Plate IV., 21 *c*;) the calyptra is large, covering the whole capsule, and is clothed with a dense felt of shaggy hairs.

Hypnum cupressiforme occurs on every conceivable habitat, but may often be found forming extensive yellowish or dark-green patches, the foliage somewhat shining. In habit this moss is most variable, being sometimes prostrate, at others erect; but usually the stem is pinnate, (Plate IV., Fig. 5,) the leaves curved to one side, more or less ovate, and suddenly drawn out to a toothed or entire point; the fruit-stalk arises from the side of the stem, and is surmounted by the curved capsule; the fringe is double, and the lid conical. Although this moss varies so much as to be fairly puzzling to the experienced bryologist, I find it may be always readily made out if a few of the leaves are taken from the stem and examined with the microscope. It will then be seen that they are either nerveless or faintly two-nerved, have very narrow elongate leaf-cells, *but the cells at the marginal base are quadrate and opaque.*

[TO BE CONTINUED.]

ERRATA.—Vol. I., page 318, line 18, for *upper* surface read *under* surface; line 19 for *involute* read *revolute.*

RECENT DISCOVERIES IN THE GEOLOGY OF SHROPSHIRE.

II.—THE QUARTZITES OF SHROPSHIRE.

BY CHARLES CALLAWAY, M.A., D.SC. LOND., F.G.S.

INTRODUCTION.

In the August number of the "Midland Naturalist," Vol. I., p. 205, I gave the first of a series of papers on my recent work in Shropshire, when I described a new area of Upper Cambrian Rocks near the Wrekin. In this communication will be found a summary of a second paper read by me before the Geological Society of London in June, 1878, and published in the August number of the *Quarterly Journal.* The reader is referred to that paper for details.

OBJECT OF THE PAPER.

On the flanks of the Wrekin and Caer Caradoc are certain beds of green sandstone and of quartz rock, which in the Survey maps are coloured as "Altered Caradoc." The green sandstone I showed in my previous paper to be the Hollybush Sandstone, (hitherto recognised only on the sides of the Malvern Hills,) and therefore of much greater antiquity than the Caradoc epoch. My present purpose is to prove that the quartzites are older even than the Hollybush Sandstone.

A. WREKIN—CHURCH STRETTON AREA.

1.—GENERAL DESCRIPTION.

(a.) *Wrekin sub-area.*—This district contains by far the largest horizontal development of the quartzites. They are finely exposed on the south-east side of the Wrekin range from its north-eastern extremity, half a mile south of Wellington, to its south-west end, a length of about three miles. The range is composed of three elevations, separated by

two narrow gorges. The south-westerly, and by far the largest, mass is the Wrekin proper, and is 1¾ miles in length. The north-easterly hill, called the Ercal, is of less height than the Wrekin and of about half the length. The central hump, Lawrence Hill, is still lower, and occupies about a quarter of a mile of the length of the range. The quartzites rest against the volcanic axis in a nearly continuous band, striking to the south-west, parallel to the axis, broken by the above-named ravines, and apparently disappearing towards the summit of the chain. They reappear, however, towards the south-west end, and lap round the south-westerly spur of the mountain. I have taken numerous dips on the flanks of the Ercal, Lawrence Hill, and the Wrekin, and find that the direction of dip is on the average a little to the east of south-east, and its amount about 45°, ranging between 30° and 55°. Other exposures on the flanks of the range are scanty. Judging by the shape of the ground and soil indications, the quartzite is probably continuous all round the Wrekin range, with the possible exception of the two points under the summit, one on each side.

The thickness of the quartzite, measured at the north-east end of the Ercal and at Lawrence Hill, is about 200 feet.

Lying to the west of the Wrekin, and connected with the quartz rocks just described by a narrow isthmus, is an irregular area of quartzite, three miles in length from north-east to south-west, and 1½ miles in its greatest breadth. Through these strata are thrust up four bosses of bedded volcanic rock, the largest of which is Charlton Hill, with two small masses immediately to the south, and a larger exposure a mile to the south-west. The dips of these quartzites are very varied. In the road one-third of a mile south of the spot marked "Charlton Mill" on the Ordnance map, they are displayed in a good section dipping south-easterly at 60°, and resting immediately upon igneous rocks. Two or three hundred yards to the north-east is quartz rock resting on porphyry of the Charlton Hill boss, and dipping to the south at 45°. One-third of a mile to the south of this last spot is another exposure of quartzite, dipping away to the south from the more southerly of the two small volcanic masses. A mile to the east-north-east of Charlton Hill, at the village of Rushton, quartz rock strikes north and south at a high dip; and a little to the north-west of Rushton the dip is westerly. One-third of a mile east of Rushton, in the quarry marked with an arrow on the map of the Geological Survey, the quartzite dips to the south at 30°. These dips are too irregular to be referred to any one upheaving force. Wherever the quartz rock occurs in close proximity to igneous rocks it dips away from them; and it seems not improbable that other dips at a distance from exposed volcanic masses may be caused by local upheavals of volcanic rock which do not appear at the surface.

(b.) *Caer Caradoc sub-area*—The quartzite reappears eight miles to the south-west of the last area, on the south-easterly flank of Caer Caradoc, near Church Stretton, an igneous hill of similar character to some of the Wrekin rocks, and evidently belonging to the same series. It is also less distinctly exposed at the south-west end of the south-east

side of the Lawley, a volcanic hill north-east of Caradoc, and separated from it by a gap about a quarter of a mile in width. If the quartzite is continuous under the superficial deposits which lie in the gap, the band will be over a mile in length. At Caer Caradoc it is about 100 feet in thickness, and dips easterly at a high angle. The quartzite is overlaid by the Hollybush Sandstone, which is well exposed in its lower part, dipping south-easterly at 75°; but towards the north-east end of the hill the sandstone shows a tendency to lap round it, and dips to a little north of east. A short distance to the south-west higher beds of the series dip east-south-east at 35°. The Hollybush Sandstone in places is highly quartzose, with grains of green earth and decomposed felspar, and is almost undistinguishable from certain parts of the basement beds of the Caradoc which appear against the same side of the axis a mile to the south-west. This similarity, doubtless, helped to mislead the earlier surveyors, and is paralleled by the equally confusing resemblance between the Shineton and Harnage Shales, which I pointed out in a previous paper.* These sources of difficulty, together with overlaps, inversions, and numerous and heavy faults, render the district a perfect maze of perplexity. Happily, the identity of the sandstones is clearly established by an excellent section exposed in a quarry at the north-east end of Little Caradoc.

In the middle of this section is a thin band which deserves special attention. It is less than one foot in thickness, and is a dark-coloured compact limestone. Associated with it is a little red shale, and near the surface of the bed the limestone assumes the same colour. This band is very fossiliferous, the most abundant form being apparently trilobitic; but it occurs in such a fragmentary condition, and is of such an unusual type, that I cannot express any opinion on its generic affinities. Brachiopoda are not uncommon: two or three species are undeterminable, save that they belong to the Tretenterata. One form, a minute roundish Lingulid, is apparently new. What is of more importance for our purpose is that the bed contains two well-known Malvern species, *Kutorgina cingulata*, Bill., and *Serpulites fistula*, Holl., both of which are found in the same formation on the flanks of the Wrekin. The Hollybush Sandstone is thus shown to overlie the quartz rock, as in the Wrekin district. It is about 300 or 400 feet in thickness, and extends to the south-west for some distance; but I have not traced it quite so far as the quartzite. Indeed, the exact limits of both formations are not ascertained, the exposures towards the south-west being very few and slight.

I have had the good fortune to discover the presence of the Shineton Shales in their true place above the Hollybush Sandstone of this sub-area. They are seen in the road leading up from the gap towards Shoots Rough. The width exposed represents a thickness of about 30 feet, and the dip is east or east-south-east apparently at 35°. They are succeeded by the Hoar Edge Grits, (Lower Caradoc,) which plunge towards them at an angle of 60° or 70°. In the Shineton district the shales are apparently conformable to the over-lying Caradoc, and the chief evidence for the

* Midland Naturalist, Vol. I., p. 206.

greater antiquity of the former is derived from fossils. Here, however, the two formations are separated by a fault, which must be of considerable throw, since, as I have reason to believe, neither the upper part of the shales nor the lower part of the sandstone is represented. Following the shales on the line of strike to the north-east into the ravine between the Lawley and the sandstone escarpment of Hoar Edge, where the escarpment approaches to within a quarter of a mile of the hill, we find them well exposed on the stream, dipping to the east at an angle of 50°, which probably represents the true dip more accurately than the shallow road-section. I have detected in them *Lingulella Nicholsoni* and Shineton Graptolites. From their general appearance, and from the presence of Graptolites, I infer that these beds belong to the middle part of the series. There are slight indications, in the shape of the ground and in the soil, that the shales run parallel to the Hollybush towards the south-west, where both are cut off by the Hoar Edge Grits (Caradoc.)

(c.) *Cardington sub-area.*—A little over a mile from Caer Caradoc to the south-east is an abrupt ridge of quartzite called the Sharp Stones, dipping to the north at from 40° to 50°, and striking east and west for about half a mile. It rests upon the bedded volcanic rocks of Cardington Hill, and is evidently tilted up by the elevation of that mass. Succeeding it to the north is Caradoc Sandstone, with its usual south-west strike, apparently unaffected by the upthrust of the older rocks, and probably separated from the quartzite by a fault.

2.—Relations of the Quartzite to the Associated Rocks.

Along the south-easterly flanks of the Wrekin range the quartz rock rests upon the bedded tuffs and felstones of the volcanic nucleus unconformably, the igneous rocks dipping north, while the quartzite dips south-east. Towards its base the quartz rock contains fragments derived from the older series, consisting of small rounded or unrounded pieces of felstone greatly decomposed, but in some cases showing distinctly the banded structure characteristic of some of the Wrekin felstones. At its base the quartzite is brecciated, both the fragments and their cement being quartzose, with the occasional occurrence of barium sulphate. This breccia can be traced along the line of junction through the Ercal, Lawrence Hill, and some distance along the south-eastern flank of the Wrekin. There are also signs of brecciation on the opposite side of the range, near the ravine between the Ercal and Lawrence Hill. This breccia may be a friction breccia, caused by the upthrust of the rigid mass of volcanic rock which forms the backbone of the range; and the fact that the breccia is not derived from the rock upon which it rests favours this conclusion. There is thus reason to conclude that the plane of junction between the younger and older series is a fault.

In my paper on the Shineton Shales, I have given reasons for concluding that the quartzites are also separated from the overlying Hollybush Sandstone by a fault. See *Quarterly Journal Geological Society*, v. xxxiii., p. 662.

3.—The Age of the Quartzites.

The quartzite is certainly older than the Hollybush Sandstone, for, in every observed case, the sandstone rests upon the quartz rock, or is at

least on the outside of it with regard to the axis of elevation. This is well seen in the Wrekin sub-area, and still more distinctly on the south-east flank of Caer Caradoc.

But the age of the Hollybush Sandstone must first be determined. It is commonly placed upon the horizon of the Ffestiniog group, on the ground that it underlies the Black Olenus Shales of Malvern, which are with great probability correlated with the Dolgelly series. But the relations of the Hollybush and Black Shales are very obscure, and it has not been shown that they succeed each other conformably. The late Mr. Belt considered the Hollybush to be a shore deposit of the Menevian sea; but I am willing to accept the former determination till decisive evidence is forthcoming. The quartzite, then, is older than the Ffestiniog period. But the Hollybush sandstone and the quartzite do not succeed each other conformably. In the Wrekin area the dips are so discordant as to suggest a considerable gap. The quartzite, in most cases, dips away from volcanic bosses, and the direction of dip is determined by these local upheavals. But the dips of the Hollybush are subject to no such law. Their general direction on the south-east of the Wrekin, where the quartzite dips south-easterly, is to the south-west; but in one place they appear to conform to the dip of the quartzite, and at a little distance they plunge at a high angle to the north-west (that is, towards the quartzite.) South of Charlton Hill, also, the sandstone dips towards the quartzite. The apparent conformability of the two formations at Caer Caradoc cannot counteract such clear evidence of discordance. Parallelism of strike does not prove conformity, since a strike fault might let down the upper of the formations without producing any alteration in the dip or strike.

It is clear, therefore, that the quartzite is older than the Hollybush Sandstone by a gap, and consequently cannot belong to any part of the Upper Cambrian series.

Three hypotheses now remain. The quartzite may be on the horizon of the top of the Lower Cambrian; or it may belong to the Lower Cambrian; or it may be Precambrian.

(a.) *The top of the Lower Cambrian (Longmynd Series.)*—The Lower Cambrian of Shropshire, as is well known, is a great series consisting of fine-grained slates or hardened shales in the lower part, and of sandstones and conglomerates above. For reasons which I cannot here detail, I believe that neither the base nor the top of the succession is seen, being cut out by faults. Does the quartzite represent a lost capping of the Longmynd rocks? I think the great discordance between the quartz rock and the Hollybush Sandstone decisively negatives this supposition.

(b.) *The Longmynd Series.*—No band of quartzite has been observed in this series from top to bottom. If the quartz rock represents any part of the Longmynd succession, where are the beds which on this supposition should intervene between the quartzite and the Precambrian volcanic series? Or is the quartzite a basement of the Longmynd rocks? If so, there should surely be some concordance of dip and strike. But the Longmynd strata in their lower part almost uniformly dip at very high angles to the west-north-west, whereas the quartzite,

as previously shown, dips away from volcanic bosses at the most varied dips and strikes.

(c.) *Precambrian.*—On the rejection of hypotheses *a* and *b*, the balance of probability is decidedly in favour of this supposition.

4.—The Fauna of the Quartzite.

For years I searched for fossils in vain; but recently I detected on the south-east flank of the Wrekin, near the cottage, one good specimen of a worm-burrow, apparently *Arenicolites*, and portions of one or two more. The burrow is a simple loop, resembling a letter U, 2 inches in length by 1 inch in breadth. I have proposed for it the name *Arenicolites uriconiensis*. If my view of the age of the quartzite is correct, this specimen is, with the exception of the problematical *Eozoon*, the oldest known fossil.

B. The Quartzite of the Stiper Stones.

The physical characters of this rock have been so well described by Murchison ("Siluria," chap. iii.,) that it will be unnecessary to make additional observations. I have but to add a suggestion on its geological age. By the author of "Siluria" it is placed on the horizon of the Lingula Flags, on the ground that it is below the Llandeilo, and contains worm-burrows and fragments of a Lingulid, which, it is candidly stated, does *not* resemble *Lingulella Davisii*. Geologists of the present day will hardly be disposed to accept such evidence as conclusive. The shales overlying the quartz rock contain *Illænus perovalis*, *Calymene parvifrons*, *Æglina*, *Placoparia*, and other Arenig forms. There can, therefore, be little doubt that the quartzite is of Arenig age, and, consequently, quite distinct from the quartzite of the Wrekin area. This view is confirmed by my recent discovery of the Shineton Shales (Tremadoc) in the valley to the east of the Stiper Stones. The two rocks can generally be distinguished from each other even in hand specimens; and, when they are conglomeratic, the pebbles of the Arenig quartzite mainly consist of quartz, while the included fragments of the Wrekin quartz rock are felsitic.

THE FERNS OF NORTHANTS.

BY G. C. DRUCE.

As might be expected from the geological and physical character of the county, Northamptonshire is very poor in ferns, only those with a large comital distribution occurring, and then but in few numbers, in widely separated localities; driven by cultivation to take refuge in some shady spinney or damp hedgerow, and most frequently to be found on the western side of the county, where they are favoured with more congenial soil and a larger rainfall than the Ceterach and Ruta-muraria of the eastern portion of the county. Indeed, so infrequent are the ferns that many inhabitants of the district are dubious about the occurrence of such universally distributed ones as *Filix-fœmina* and

Scolopendrium, and can scarcely believe that in a single walk from its chief town as many as twelve species have been noticed. The following is my compilation of the localities of the ferns of Northants:—

Pteris aquilina, L., generally distributed, with the exception of the district drained by the Tove, where it is absent or rare. Plentiful in Harleston, coming to within three miles of Northampton, where, however, last year a plant grew on the brickwork of a wharf, introduced there by some spores carried by the river from Harleston.

Lomaria spicant, Desv., a very rare fern, occurs in Badby Wood and in Harleston Firs. In the latter place it disappeared for a year or two, but is now again abundant. These, together with the old locality of King's Cliff, are in the Nene system. Mr. French records it from near Brackley, and Mr. Beesley from Newbottle, the latter localities probably drained by the Cherwell.

Asplenium Ruta-muraria, L., Wall Rue, occurs at Dallington, within two miles of Northampton, on Brampton Bridge, at Overstone, (Mrs. Birch,) and very plentiful about our President's (Lord Lilford) estate, at Lilford, as noticed in Morton's History, tempore 1700; also at Barnack and Walcot Hall, and in the west of the county at Sulgrave, Astrop, (Mr. E. Walford,) Watford Church, &c.

A. Adiantum-nigrum, L., very rare, at Duston Stone Pits and Harleston Lane, Astrop, (Walford,) and King Sutton, (French,) the two latter drained by the Cherwell.

A. Trichomanes, L., not given in "Top. Bot." for 32. At Lamport, probably an escape; at Great Billing, on Irthlingborough Bridge, Nene drainage, and near Towcester, (Norman,) Tove drainage.

Athyrium Filix-fœmina, B., very fine in Delapre Woods; also, in Harleston Firs, Duston, Badby Wood, Yardley Chase, Overstone, (Mrs. Birch,) Bedford Purlieus, (Mr. Bodger,) all in Nene system, and near Banbury, (T. Beesley.) This is not included in "Top. Botany."

Scolopendrium vulgare, Sm., Harleston stone pits, Badby, Newnham, Clifford Hill, (Law), Nene; Barby, (H. W. Trott), Avon; Eydon, Cherwell; and Wappenham, Yardley Gobion, &c., Ouse. It is very frequently found growing in the stonework of village wells, some splendid plants occurring at Yardley Gobion and Lamport.

Aspidium aculeatum, Sw., plentiful in Harleston quarries, and also in Maidwell Dales, (Law,) the only localities in Nene drainage; it is very frequent in hedgerows in the west of county drained by the Cherwell, Leam, and Avon. I should place Maidwell Dales as the limits of its easterly range.

A. lobatum, Harleston, Astrop, (Walford,) Chacombe, (Beesley,) Newnham Lane (Notcutt).

A. angulare, W., Mr. Griffin tells me he has gathered at Badby Woods.

Nephrodium Filix-mas, Rich., generally distributed, although less frequent easterly. In Delapre Woods occurred a form very near *affine*.

N. dilatatum, Desv., Harleston, Duston, Badby Woods, Delapre, &c., all in Nene system.

N. spinulosum, Desv., Harleston, Badby Woods, Yardley Chase, Nene, and near Banbury, (French.)

N. Thelypteris, Desv., only on authority of Baker's History, at Overstone; now extinct.

N. Oreopteris, Desv., recorded from Harleston, East Haddon, and Badby, Nene, but not recently found; likely to occur at Badby.

Polypodium vulgare, L., generally distributed, but rare in Tove system.

Ceterach officinarum, Willd., on walls at Barnack, Biggin, (Rev. M. J. Berkeley,) Astrop, (J. Beesley.)

Osmunda regalis, L., Moulton, (Baker's Hist.,) now extinct.

Ophioglossum vulgatum, L., generally distributed; Brampton Meadows, nearest locality to Northampton.

Botrychium Lunaria, Sw., recorded from Harleston Heath, (Baker's Hist.,) not recently found; Oldfield, (Morton's Nat. Hist.,) extinct.

None of the Club Mosses occur in Northants, and *Pilularia globulifera* is only recorded in Morton's Hist., from Boro' fen.

Reviews.

The Fairy-Land of Science. By ARABELLA B. BUCKLEY, Author of 'A Short History of Natural Science,' 'Botanical Tables for Young Students,' etc.—London: Edward Stanford, 1878, pp. 244, illustrated.

THE influence of the master over the mind of the intelligent pupil is always manifested. Not that we have any knowledge that the accomplished lady—the Mary Somerville of our day—whose name appears above ever studied personally under Professor Huxley, but there can be little doubt that the public teaching of our greatest English biologist, in addition to her association with the late Sir Charles Lyell as his Secretary, has had much to do in moulding her scientific character, and in developing the very interesting and beautiful work before us. In his admirable "Physiography"—a book which should be in the hands of every scientific student—Professor Huxley proposed "not to trouble his hearers much about latitudes and longitudes, the heights of mountains, the depths of seas, or the geographical distribution of Kangaroos and *Compositæ*," specially as such, but he approached the study of nature after a fashion of his own by giving in very broad and accurate outlines a view of the "place in nature" of a particular district of England—the basin of the Thames, and all the phenomena connected therewith — in fact, a chapter of the history of the Universe.

Here is a little book, a worthy companion of the "Physiography," wherein the author contemplates Nature from her own standpoint, and in graceful fancy attributes to the doings of the fairies in the "Fairy-Land of Science," the wonders and marvels—termed by Philosophers "the forces of Nature"—constantly going on around and among us. The result is that in this attractive guise any child of fair intelligence is held spell-bound in the subject as in the narration of a nursery story, and, what is better, is drawn on to more advanced studies. Every father of a family who wishes his children to know something of Natural Science should buy this little book and present it to them as a New Year's gift. And even "the gray-haired boys" may here read and learn.

In her preface the authoress, speaking of its origin, says:—"The ten lectures, of which this volume is composed, were delivered last spring, in St. John's Wood, to a large audience of children and their friends, and at their conclusion I was asked by many of those present to publish them for a child's reading book. At first I hesitated, feeling that written words can never produce the same effect as *viva-voce* delivery. But the majority of my juvenile readers were so deeply interested that I was encouraged to think that the present work may be a source of pleasure to a wider circle of young people, and at the same time awaken in them a love of nature and of the study of science." The public are much indebted to Miss Buckley for acceding to the wishes of her friends and for the enlarged series of Lectures which she has given

us. The titles themselves are sufficiently suggestive of their contents. 1. "The Fairy-Land of Science, how to Enter it, how to Use it, and how to Enjoy it." 2. "Sunbeams and the Work they do." 3. "The Aerial Ocean in which we Live." 4. "A Drop of Water on its Travels." 5. "The Two great Sculptors—Water and Ice." 6. "The Voices of Nature and how we Hear Them." 7. "The Life of a Primrose." 8. "The History of a Piece of Coal." 9. "Bees in the Hive." 10. "Bees and Flowers."

Perhaps the most interesting Lecture is that on "The Two great Sculptors—Water and Ice." It is an old story told in a new dress. As the sculptor fashions his rude block of marble perchance into the image of the lovely Galatea, so we have Water described as fashioning the face of the earth into the steep slopes and gentle curves, "the hills, valleys, gorges, ravines, slopes, plains, caves, grottos, and rocky shores"—and Ice as breaking up the ground, and forming the glacier—its progress and its destiny—with the marks it leaves in its erratic boulders and its striations of hard rocks.

In "The History of a Piece of Coal"—after tracing its existence from the far-off period when the sunbeams developed the ferns, calamites, lepidodendrons and sigillarias to its presence in the mine and its value to our manufactories, industries, and its essential aid to our comforts, the author says:—"All this, then, those plants and trees of the far-off ages, which seemed to lead such useless lives, have done and are doing for us. There are many people in the world who complain that life is dull, that they do not see the use of it, and that there seems no work specially for them to do. I would advise such people, whether they are grown up or little children, to read the story of the plants which form the coal. These saw no result during their own short existences, they only lived and enjoyed the bright sunshine and did their work, and were content. And now, thousands, probably millions of years after they lived and died, England owes her greatness and we much of our happiness and comfort to the sunbeams which those plants wove into their lives. They burst forth again in our fires, in our brilliant lights, and in our engines, and do the greater part of our work; teaching us—

'That nothing walks with aimless feet,
That not one life shall be destroyed,
Or cast as rubbish to the void,
When God hath made the pile complete.'"

The language of the book is simple, graceful, and forcible, and there is a reverent spirit pervading it throughout. The engravings are beautifully executed, and add much to its value, and many are original. The experiments are easy and within reach of average youth. With so much to commend, it seems almost ungracious to make a suggestion, but we think that—as it is intended for youth—the book would be improved by giving, as Professor Huxley has in foot notes to the "Physiography," the Greek roots of all generic and specific names derived therefrom. Authoress, artist, printer, bookbinder, and publisher must be congratulated on producing one of the most charmingly attractive volumes of its kind ever published.

W. R. Hughes.

The Geological Record for 1876. Edited by W. WHITAKER, B.A., F.G.S. Published by Taylor and Francis. Price to subscribers, 10s. 6d.

THIS is the third volume of this most useful and, to every geological worker, indispensable book. It contains 415 closely printed pages, embracing not only the title, but a short abstract of every paper or book bearing upon the science of geology which was published during the year 1876, either in the British Isles or abroad, all properly classified, together with lists of the new fossils described, &c. Some idea of the immense amount of labour involved may be had from the fact that the total number of abstracts amounts to nearly 2,400. The British Association has recognised the need for and value of this publication by making an annual grant of £100 towards its cost, and the extremely low price at which it is published should enable every student to obtain it as a work of reference.

Nowadays it is absolutely necessary to know what other workers have done or are doing in the field of research in which we ourselves are engaged. For want of this knowledge countless blunders have been committed in the past, every science has been loaded with unnecessary synonyms, and much duplicate work has been done.

Mr. Whitaker has long been known as an indefatigable worker both in the library and in the field; but in the preparation of the *Geological Record* he has been ably aided by several of his colleagues on the Geological Survey and by others. Among these we may mention Messrs. Topley, Dalton, Lebour, Drew, Etheridge, jun., Tawney, H. B. Woodward, &c., and Profs. Bonney, Rudler, Miall, and Nicholson.

One of the great difficulties in connection with the work is the fact that many authors and societies do not punctually send copies of their papers, transactions, &c., to the editor, (at the Geological Museum, Jermyn Street, S.W.,) or to the Library of the Geological Society, at Burlington House, Piccadilly, where they might be consulted.

W. J. H.

The Small Heath Literary Magazine. No. 3. January, 1879. Price 1s. Birmingham: Davis Bros.

THIS excellent magazine, the papers in which are contributed solely by members of the Small Heath Literary and Scientific Society, is a most praiseworthy publication, and we warmly congratulate the editors on being able to issue such an interesting and highly creditable serial. Although the subject-matter of the papers is mainly of a non-scientific character, we do not think it is out of place to record in these pages our warm appreciation of the good work one of the societies in the "Midland Union" is doing by giving publicity to the literary productions of its members. We sincerely hope it may obtain all the success it deserves.

ERRATA.—NOTTINGHAMSHIRE CONCHOLOGY, &c.—Vol. I., page 309, lines 1 and 14, for *Testacella Maugei* read *T. haliotidea;* on page 308, line 5, Notts Ferns, for *Polystichum angulare* read *P. aculeatum.* The former is also found in the county.

Microscopy.

The annual report of the POSTAL MICROSCOPICAL SOCIETY for 1878 is an interesting document which every microscopist would do well to read. The Society has been in existence five years, and now consists of 140 members, under the presidency of Mr. Tuffen West, F.L.S., &c. The Society was formed to meet a want long felt of a ready means of communication between Microscopists living at a distance from each other. The members are divided into sections or circuits, twelve in each, arranged geographically. At intervals of a fortnight the Secretary, Mr. Alfred Allen, 1, Cambridge Place, Bath, sends to each of the members whose names stand first in the several circuits a box of microscopical slides. These are retained for three evenings and then forwarded to the names second on the lists, and, after a like interval, are forwarded to the third names, and so on, till the circuits have been completed, the last recipient returning the slides to the Secretary, who then sets them once more in circulation, so that every member in turn sees every collection of slides, and is constantly supplied with fresh subjects for microscopic examination.

But not only are microscopical slides, many of the highest interest, constantly distributed among the members, but very often they are accompanied by MS. descriptions, and elucidatory drawings which materially assist the study and appreciation of the more difficult objects. A society such as this, well and energetically managed, including many of our best microscopists among its members, cannot fail to be very useful. Some idea of the nature and extent of its operations may be gleaned from the Society's last report, and the President's address accompanying it, which, together with list of members, rules, &c., can be obtained from the Secretary.

In consequence of a number of gentlemen of the medical profession having recently joined the Society, it has been arranged to circulate a special series of histological and pathological slides. These special slides will circulate almost exclusively amongst the medical members, at monthly intervals, in addition to the usual fortnightly box of slides which goes the whole circuit of the Society, whether members are medical or otherwise. The Society is also proposing, at the request of many members, to circulate a series of slides devoted to botanical subjects. These, after going the round of the contributors, it is proposed should go the whole circuit of the members.

The Society has recently issued a "Classified List of Objects" circulated among the members from the commencement of its existence to the end of its fourth year, (June, 1877,) and we do not think we are far wrong in stating that the list consists of 2,000 objects, many of them mounted by the members. Some measure of its usefulness and activity is indicated by this statement.

Amongst the rules, which are all carefully drawn up and appear in every way fitted to meet the exigencies of a *Postal* Society, is one which provides that ladies may be members of the society. Another feature of this society, designed expressly for the purpose of promoting friendly feeling, is that each member on admission to the society is requested to send his or her *carte de visite* to the secretary, and as soon as a sufficient number are collected they are grouped together and reproduced in permanent photography, and sold to the members at the lowest remunerative price. We have seen a copy of the last-issued group, which contains seventy-three portraits, excellently arranged and well printed. This group makes us acquainted with the portraits of many well known microscopists, and with several who have contributed

to the pages of this magazine. It only remains to mention that the entrance fee is 2s. 6d., and the annual subscription 10s.

Mr. T. Bolton's Agency for the Distribution of Living Organisms amongst Microscopists is, we are glad to find, being widely appreciated and made use of. He has already as subscribers of one guinea for twenty-six tubes, to be supplied in the course of six months, usually one per week, or more rapidly if desired, several Microscopical Societies, Science Schools, and many leading microscopists in all parts of the United Kingdom. We have glanced at the list of objects sent out by him during the past six weeks, and we find amongst them larvæ of the Marine Polyzoon described at page 26, Raphidiophrys pallida, Epistylis grandis, Euglena viridis, Chilodon cucullulus (?), Œcistes crystallinus, Floscularia cornuta, Trout spawn, Stephanoceros Eichhornii, Amœba, Nitella translucens in fructification, Volvox globator, many kinds of Rotifers, &c., of some of which he has also been able to distribute good illustrations and descriptions through the kindness of Professor E. Ray Lankester, Mr. Saville W. Kent, and Mr. H. E. Forrest. We can from personal experience speak of the satisfactory manner in which Mr. Bolton sends out his specimens, and can recommend anyone desiring useful occupation for their microscopes to make use of Mr. Bolton's services. His address is 17, Ann Street, Birmingham.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF DECEMBER, 1878.

BY W. JEROME HARRISON, F.G.S.

December commenced with five or six days of unsettled weather, but on the 7th cold weather set in and continued to the 28th. The severity of the cold during this period was greater than in any year since 1860. Our lowest temperature recorded was at Coston Rectory, near Melton Mowbray, (Rev. A. M. Rendell,) 2° below zero, indicated by *two* registering minimum thermometers, and at Stoney Middleton a temperature of −1° was indicated. This was on Christmas Eve. Of the three weeks' frost the Rev. J. Brooke (Shifnal) writes "By far the coldest December for at least forty-four years;" the Rev. J. M. Mello, (Chesterfield,) "It is forty-one years since such severe weather set in so early, and such a low temperature as 5° (on the 25th) has not been known since 1860 in this district;" Mr. H. E. Bellamy, (Oxford,) "The mean temperature of December was lower than of any month since 1860, except December, 1874, which was about the same." Ice on still water attained from 6in. to 7in. in thickness. "The Trent was frozen over, and at Nottingham, on Christmas Day, hundreds of people were skating on it" (Mr. H. F. Johnson.) From the 11th to the 15th the "ragged rime" on the trees presented a beautiful appearance, the ice-needles being an inch in length, and varying with the direction of the wind, as Mr. Mott has so well pointed out ("Midland Naturalist," Vol. II., p. 22.) A "silver thaw" set in on the 26th, rain falling and freezing on the roads, which became a sheet of ice. Mr. Markham (Pitsford) says, "The people here were able to skate from Northampton to Pitsford and back by Brampton, a distance of ten miles on the road." This was another instance of the fact that atmospheric changes first set in in the higher regions of the atmosphere, and shows the importance of having meteorological stations on the highest points in any country. Rainfall was about an average. It consisted largely of snow, which fell heavily on the 18th and 21st. The barometer was low and unsteady. Northerly and westerly winds prevailed, but there was a marked absence of tempestuous weather.

STATION.	OBSERVER.	RAINFALL. Total for M. In.	Greatest fall in 24 hours. In.	Greatest fall in 24 hours. Date.	No. of rainy d.	TEMPERATURE. Greatest ht. Deg	Greatest ht. Date.	Great'st cold. Deg	Great'st cold. Date.
GLOUCESTERSHIRE.									
Cainscross, Stroud	W. B. Baker, Esq.	1·99	1·36	29	4	56·0	30	11·0	24
Cheltenham	R. Tyrer, Esq.	1·90	·50	25	12	53·5	30	4·8	25
Stroud	T. J. Coley, Esq	1·74	·58	26	7	53·0	31	15·0	24
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	2·16	·32	1	13	51·0	31	11·0	25
Whitchurch	A. B. George, Esq.	3·23	·50	26	11			8·0	24
Woolstaston	Rev. E. D. Carr	2·88	·39	29	15	50·0	31	18·0	14,15, 17,
Leaton Vicarage, Shrewsbury	Rev. E. V. Pigott	1·70	·29	28	17	51·8	31	7·1	25 (25
More Rectory, Bishop's Castle	Rev. A. Male	2·72	·34	28	18	50·0	30 & 31	6·0	25
Bishop's Castle	E. Griffiths, Esq.	2·40			16	50·0	30 & 31	11·0	24
Cardington	Rev. Wm. Elliott	2·73	·39	28	18				
Adderley Rectory	Rev. A. Corbet	2·28	·38	1	15				
Stokesay	Rev. J. D. La Touche	2·19	·41	28	17	52·4	31	4·2	24
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	2·15	·53	28	15			6·0	25
Stoke Bliss	Rev. G. E. Alexander	1·84	·34	24	13	52·0	31	10·0	24
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq	2·08	·39	28	15	54·0	31	7·7	25
West Malvern	A. H. Hartland, Esq.	1·93	·49	25	11	44·5	28	16·5	13
Pedmore	E. B. Marten, Esq.	1·78	s)·32	25	16	50·0	31	10·0	24
Stourbridge	Mr. J. Jeffries	1·79	·35	25	13	50·0	30 & 31	10·0	24
St. Johns, Worcester	G. B. Wetheral, Esq.	1·88	·80	26	9	51·0	31	11·0	24
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	1·89	·25	29	13				
Amblecote	Mr. J. Robins	1·59	·30	26	15				
Dudley	Mr. J. Fisher	1·68	·28	26	12	56·0	29	18·0	23 & 24
Sedgley	Mr. C. Beale	1·72	·52	26	17	48·0	30 & 31	20·0	24
Kinver	Rev. W. H. Bolton	1·81	·29	28	16	46·0	30 & 31	10·0	24
Walsall	Mr. N. E. Best	2·22	·40	25	17	49·0	31	26·0	14
Grammar School, Burton	C. U. Tripp, Esq.	2·41	s)·46	26	17	53·0	31	9·0	25
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	2·47	s)·33	27	15	52·0	31	3·0	25
Wrottesley	E. Simpson, Esq.	1·95	·36	26	15	49·8	31	10·6	25
Tamworth	W. Arnold, Esq.	2·35	s)·50	25	12				
Heath House, Cheadle	J. G. Philips, Esq.	2·5	·43	18	13	49·0	30	17·0	14 & 25
Alstonfield Vicarage	Rev. W. H. Purchas	0·66	·35	1	5	48·7	31	12·0	11
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	1·93	·46	25	16	51·0	31	14·0	24
Coventry	J. Gulson, Esq.	1·93	·42	25	17			14·0	25
Bickenhill Vicarage	J. Ward, Esq.	2·34	·45	27	16	44·0		13·0	
St. Mary's College, Oscott	Rev. S. J. Whitty	2·04	·44	25	20	51·1	30	12·7	25
Henley-in-Arden	T. H. G. Newton, Esq.	2·15	s)·52	26	14	53·0	31	4·0	25
Rugby School	Rev. T. N. Hutchinson	1·99	·42	26	15	52·4	30	11·0	24
DERBYSHIRE.									
Stoney Middleton	Rev. U. Smith	1·68	·37	28	11	49·0	31	–1·0	24
Brampton St. Thomas	Rev. J. M. Mello	1·32	·56	25	7	49·0	30 & 31	5·0	25
Fernslope, Belper	J. G. Jackson, Esq.	1·89	s)·58	25	18	49·0	30	10·0	25
Linacre Reservoir	C. E. Jones, Esq.	1·54	·65	25	11				
Willesley Gardens	J. Tissington, Esq.	2·29							
Spondon	J. T. Barber, Esq.	2·29	·65	24	13	51·2	31	6·9	24
YORKSHIRE.									
Hesley Hall	B. J. Whitaker, Esq.	1·53	1·32	30	6	49·0	31	9·0	21
NOTTINGHAMSHIRE.									
Tuxford	J. N. Dufty, Esq.	1·58				49·0	31	13·0	24
Highfield House, Nottingh'm	E. J. Lowe, Esq.	2·50	·75	26	15	59·1	31	5·9	25
Hodsock Priory, Worksop	H. Mellish, Esq.	1·54	·70	25	15	58·1	31	9·8	25
Park Hill, Nottingham	H. F. Johnson, Esq.	2·33	·60	26	15	52·5	31	13·5	24
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	1·87	·45	26	12	61·1	31	5·8	25
Ashby Magna	Rev. E. Willes	1·77	·46	26	10				
Market Harborough	S. W. Cox, Esq.	1·65	1·00	27	10	50·0	31	8·0	25
Kibworth	T. Macauley, Esq.	1·86	·65	25				11·0	24
Town Museum, Leicester	W. J. Harrison, Esq.	1·81	·42	26	15	52·5	31	6·9	25
Belmont Villas, Leicester	H. Billson, Esq.	1·88	·46	26		52·8	31	9·8	25
Syston	J. Hames, jun., Esq.	1·77	·70	26	14	47·0	30 & 31	10·0	25
Waltham-le-Wold	E. Ball, Esq.	1·94	·42	25	14	48·0	30	16·0	24
Little Dalby Hall	G. Jones, Esq.	1·54	·41	26	16	51·0	31	7·0	25
Coston Rectory, Melton	Rev. A. M. Rendell	1·73	s)·37	25	15	52·1	31	–2·0	25
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	1·81	s r)·45	25	15				
Castle Ashby	B. G. Scriven, Esq.	1·5	·48	25	9	50·0	31	15·0	24
Pitsford	C. A. Markham, Esq.	1·78	·42	26	14	51·0	31	9·0	25
Kettering	J. Wallis, Esq.	1·66	·41	26	16	50·0	31	14·0	25
Althorpe	W. F. Jakeman, Esq.	1·53	·35	25	15	52·0	31	10·0	25
RUTLAND.									
Burley-on-the-Hill	W. Temple, Esq.	1·63	s r)·98	25	6	49·0	30	16·0	14
West Deyne, Uppingham	Rev. G. H. Mullins	1·65	s)·40	25	13	51·6	31	17·9	25
Northfields, Stamford	W. Hayes, Esq.	1·39	·49	26	14	41·5	5	13·0	25
Radcliffe Observatory, Oxford	Mr. H. E. Bellamy	1·51	·40	25	11	53·6	29	5·6	24
Spital Cemetery, Carlisle	T. Bell, Esq.	1·52	1·04	(r s) 29	4	51·0	31	5·0	23
Ventnor Hospital	H. Sagar, Esq.	1·89	·30	29	20	50·7	31	24·1	15
Altarnun Vicarage	Rev. G. Tripp	6·08	1·08	29	13	53·0	30 & 31	8·0	11

Thunder was heard at Stokesay on the 30th, and a lunar rainbow was seen there on the night of the 31st. The birds suffered greatly from the cold. From many places they disappeared altogether, doubtless going southward in search of a warmer climate. Mr. Ball, of Waltham, says: "Previous to the frost, great numbers of small birds were observed going southwards. Numbers of rooks, crows, sparrows, and robins perished here during the frost." At More Rectory, (Rev. A. S. Male,) "Winter birds, fieldfares, &c., were abundant and very tame. One hawfinch was killed on the 31st. The rooks were so tame with hunger that they came to feed with the small birds at the window." At Nottingham, (Mr. Johnson,) "Great quantities of small birds have died in this neighbourhood, and we have had some fresh arrivals, as bramble-finches and redwings."

RAINFALL OF 1878.—We have received the following returns:—

Coventry	34·81in.	Stoke Bliss	36·92in.
Leicester (Town Museum)	29·73in.	Nottingham (E. J. Lowe, Esq.)	32.97in.
Spondon	32·32in.	Ashby Magna	27·16in.
Hodsock Priory	24.88in.	Syston	28·76in.
Kettering	27·16in.	Coston Rectory	28·27in.
Tuxford	29·73in.	Cheltenham	33·18in.
Cheadle	37·57in.		
Adderley Rectory	32·16in.		

For observers' names and counties see the monthly list. These returns show an average excess of about ten per cent., chiefly due to the months of May and August. It was the fourth year of excessive rains, the last "dry season" having been in 1874.

Correspondence.

SNOW CRYSTALS.—Information how these may be observed under the microscope would be most acceptable.—ENQUIRER.

FRESHWATER POLYZOA.—Will some one kindly describe a good method for preserving these interesting objects, with tentacles expanded for examination under the microscope?—M.

ROTIFERS.—I have tried in vain to preserve these interesting animalcules as microscopical specimens, but have, so far, been most unsuccessful. Will some reader of the "Midland Naturalist" communicate a method which has stood the test of experience?—J. N.

WILD GOOSE.—It may interest some of the readers of the "Midland Naturalist" to know that one of the boys in this village captured, on Christmas Day last, a wild goose. The bird lighted in a field near to where the lad was singing carols, and was too exhausted to fly further. It weighed 10lbs., and measured 7ft. between the tips of the wings.—WM. ELLIOT, Cardington.

TABLETS TO MOUNT SPECIMENS ON.—Referring to a note on tablets for mounting specimens at page 25, I may say that the pasteboard recommended by Professor Miall answers admirably. But his plan of indicating formations or classes by different colours does not answer so well, since most of the colours fade very soon. In my own cabinet I have, for that reason, adopted one quiet permanent colour.—C. CALLAWAY. D.Sc., Wellington.

A Rare Bird.—A fine specimen of the bittern (*Bataurus stellaris*, Selby,) was shot near Leicester, on December 28th, and is now in the possession of Messrs. W. Adcock and Son, Taxidermists, 96, Dorset Street, Leicester.—C. A.

How are the Shells of Garden Snails Formed?—Will Mr. Tye or some other conchologist give a description of the mode in which the common garden snail developes its shell? By what means does the tiny thing by which the baby snail is protected grow with its growth, enlarging and yet retaining its proper form, enriched by its typical markings? The history cannot fail to prove intensely interesting.—H. Cole.

What is the cause of Hardiness in Plants?—Why does frost kill some plants and produce no effect on others? I should be much obliged if some one will enlighten me on this most interesting subject. Are there any published papers in which the question is well discussed? It seems to me a subject of great importance; but I am unaware that anything of real value concerning it has yet appeared. Information will be valuable to many besides myself.—W. E.

Aquaria.—Will some of the readers of the "Midland Naturalist" kindly inform me what is the best artificial food for freshwater fishes, viz., carp, minnows, perch, tench, dace, roach, &c., as I find a difficulty in feeding them properly at this time of the year. Two or three of my gold carp were covered with a sort of white fungus, and died in a few days after that made its appearance. Can anyone explain this, and if there is any cure? Any information on the management of Aquaria generally would be esteemed a favour.—H. M., Derby.

The Midland Union and the "Midland Naturalist."—I have been making enquiries as to the number of members who subscribe for the magazine, and I am astonished to find how few show any willingness to support a publication which has already done much useful work for our Natural History Societies. I desire to offer a suggestion. Let every member who is already a subscriber make up his mind to get one, or, better still, two fresh subscribers for the current year. To do this need involve very little trouble, as among his fellow-members every one can surely influence some one by his recommendation. It will be a poor return for the gratuitous labours of the editors, and for the enterprise and good nature of the publishers, if the Societies in the Union will not, each and all, lend a helping hand to ensure the permanent publication of the "Midland Naturalist." Every student of any branch of Natural History in the Midland Counties ought to feel himself bound in honour to do what he can to increase the circulation of our valuable monthly.—F. E. L.

Frost Phenomena.—At page 22 is a very interesting account by Mr. F. T. Mott, of Leicester. I will add a line or two as to a very beautiful phenomenon which I noticed here on Christmas night last. The first great frost of the memorable winter of 1878-9 commenced on the 6th and terminated on the 25th of December by a thaw and subsequent rain in the afternoon and evening. To this succeeded, about ten o'clock at night, a sharp frost. The partially melted snow on the trees and hedges, and apparently the rain itself, formed a mass of icicles, covering almost every twig and branch of hedge and tree. They were variously club-shaped, spindle-shaped, or coral-shaped, and in the gaslight sparkled like brilliants. Moreover, as a gentle wind sometimes passed through the trees, a peculiar grating sound was heard as the icicles ground against each other, not of an unmusical character, as though calcareous matter in the nature of coral had been gently rubbed together. This was observed between eleven and twelve o'clock at night.—W. R. Hughes, Handsworth Wood, near Birmingham.

Hedgehog.—My garden is entirely walled-in, and near the bottom there is a raised bank supported by a wall of casting pots placed with the open ends outwards. In November, 1876, a friend gave me a young hedgehog about one-third grown. He lived in the garden, but was only visible at intervals of a month or six weeks. Desiring to find where he hid himself I carefully searched the garden, and on examining the casting pots I observed one about 15in. from the ground filled to the very mouth with dead leaves, of which there was a large quantity on the ground near. On removing the leaves from the casting pot I found them *quite densely packed together*—not as if they had been loosely cast in, but as if they had been subjected to both arrangement and pressure—and about 5in. from the mouth of the casting pot appeared the prickles of the hedgehog. Query—How came he there? I had no other domestic pet to "tuck him up" after he had got into his cosy bed, and the cats of the neighbourhood can hardly be credited with it. Probably some Naturalist can solve the question. My own guess is that he filled the hole with leaves, and then with a screwing motion of his body used his prickles to draw in the leaves after him as he bored his way through them.—R. Hugh Burman, Handsworth.

Northampton Castle.—Many readers of the "Midland Naturalist" are aware that with the progress of the new line of the North-Western Railway, by which Northampton is placed on the main line of their system, the old Castle of Northampton, built by Simon de St. Liz, will be completely destroyed, the site being required for the sidings of the new station. Excavators have for some time been at work, and have now laid bare the foundation of the western walls and postern gate, and a memorial has been signed asking the North-Western Company to incorporate or utilise in some way this block of masonry if possible. A committee of Archæologists has been formed to watch the excavations in case anything of interest should be unearthed. The walls of the Castle, and particularly the south bastion, were interesting, as being the only Northants locality for *Diplotaxis tenuifolia* &c.; and among other interesting plants growing on them may be mentioned *Echium vulgare*, *Linaria vulgaris*, *Sedum album* and *reflexum*, *Poa compressa*, *Antirrhinum majus*, *Cheiranthus cheiri*, &c. Burgess, in his Wild Flowers, I believe, alludes to the profusion of *Malva sylvestris* growing in the Castle moat, but this has disappeared, nor can *Fritillaria meleagris* be now seen in the meadows near, although *Colchicum autumnale* still appears, making the fields gay in September within a few hundred yards of this site.—G. C. Druce.

Gleanings.

Ornithology.—We have received from Dr. E. Rey, of Leipzig, the first and second parts of a general (priced) catalogue of birds. The prices appear moderate, as the skins are guaranteed to be in good order.

Molluscan Threads.—Mr. G. Sherriff Tye contributed to the November number of "The Quarterly Journal of Conchology" a most interesting paper on the threads spun by Mollusks. The paper was read before the Birmingham Natural History and Microscopical Society.

Photography.—We have received from Mr. J. Vincent Elsden an excellent photographic enlargement of the diatoms *Triceratium favus* and *T. megastomum*. These are enlarged to a diameter of from 1in. to 1½in., and the details are brought out with considerable clearness.

Geological Survey.—The mapping of sheet 70 (N.-E. Leicestershire, East Notts, and South Lincolnshire) has been all but completed by Mr. W. H. Holloway, F.G.S. Very little local work has been done in this region, and we trust that a full descriptive memoir will be published concerning it.

Petrology.—We are glad to hear that Mr. F. Rutley, F.G.S., has written a book upon this subject, which will be published in a few weeks. We pointed out the necessity for such a work in our review of Mr. Rutley's memoir on "Brent Tor," last month, (page 17,) and are glad to find that he has anticipated our wishes.

Natural History of the Ant.—The Rev. Henry McCook, of the Academy of Natural Sciences, Philadelphia, announces the proposed publication, by subscription, (four dollars,) of a Monograph of the Agricultural Ant of Texas. From the syllabus of the work the doings of these creatures appear to be of a very extraordinary character, and have been minutely studied by the author "while encamped in the midst of a large colony of formicaries." There are twenty-four plates, containing a large number of illustrations, drawn from nature.

Norwich Geological Society.—The prosecution of the Geological Survey in the Eastern Counties has naturally given an impetus to the work of the various scientific societies of that district. As one result of this movement, we are glad to see that the Norwich Geological Society has commenced the publication of their "Proceedings." Part I. contains a list of papers communicated to the Society from its establishment in 1864 up to November, 1877, and also abstracts of several papers read during the session 1877-8. Part II. consists of a very able address delivered by the President, H. B. Woodward, Esq., F.G.S., in which much valuable information on glacial topics is contained.

The Birmingham Reference Library, which included the deservedly-famous Shakespeare Library, the Cervantes Library, and the unique Staunton Collection (relating to Warwickshire history,) was destroyed by fire on the afternoon of Saturday, January 11th, 1879. The loss is one deplored by everyone, and many of the treasures destroyed can never be replaced. With characteristic energy, Birmingham at once set to work to provide funds for the formation of another library as good as money judiciously spent can provide. Within a week of the fire more than £10,000 was subscribed. There is no doubt that £15,000 will soon be raised, which is the sum required in addition to the insurance money to reinstate the buildings and fill them with the necessary books, &c. We have reason to believe that scientific literature will be fully represented in the new Reference Library.

The Present Severe Winter seems to have been plainly foreseen by Professor Piazzi Smyth, the Astronomer Royal of Scotland, so long ago as 1872. In a communication made by him to *Nature*, of February 22nd, in that year, commenting on the observations made with the rock thermometers at the Royal Observatory, Edinburgh, during many preceding years, he states that the most striking features of the observations are (1) the great heat-wave which occurs every eleven years and a fraction, and nearly coincidently with the beginning of the increase of each sun-spot cycle of the same eleven-year duration, and (2) the extreme cold found on either side of the great heat-wave, and he points out that the next occurrence of the minimum temperature of the then next cold wave might be looked for at the end of last year, (1878,) and the early part of the present year, and that the next heat-wave will occur in or about 1880.

Reports of Societies.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY.—January 1st.—The Annual Soirée was held in the Bristol Street Board School. 140 tickets were issued, and the meeting proved a very enjoyable one. Mr. G. T. Cashmore exhibited an arrangement of mirrors for illustrating the law of symmetry in crystals. Messrs. P. Harris and Co. lent an induction coil and vacuum tubes. Various members contributed telephones, microphone, electro-thermoscope, and microscopes. Mr. C. Pumphrey exhibited a number of beautiful stereoscopic views of remarkable scenery. At eight o'clock an amusing scientific farce, interspersed with experiments and songs, was performed by Messrs. A. Cresswell, R. Birbeck, and C. E. Crick. Refreshments were then served under the superintendence of Mrs. Cresswell, and dancing commenced and was kept up with much spirit until midnight.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—December 17th.—MICROSCOPICAL GENERAL MEETING.—Mr. Graham exhibited the Cat's-Eye Pearl from Japan. Mr. W. R. Hughes read the seventh of a series of papers on "The Entozoa and Ectozoa," by T. Spencer Cobbold, M.D. January 7th.—GENERAL MEETING.—Mr. J. E. Bagnall exhibited *Œdipodium Griffithianum* from Snowdon, and capsule of sphagnum to show the stomata.—Mr. R. M. Lloyd exhibited some live specimens of the river lamprey *(Petromyzon fluviatilis.)* Mr. W. Southall read the first part of a paper on "The Flora and Fauna of Edgbaston," but, after having read the first part, at the request of the Chairman, he promised to read the entire paper at a future meeting.

CHELTENHAM NATURAL SCIENCE SOCIETY.—January 16. Geo. Ferguson, Esq., M.D., M.A., read a most interesting paper on the "Planet Mars and its Alleged Habitability." The paper was well illustrated by diagrams.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.—NATURAL SCIENCE SECTION.—December 20th.—Mr. Jas. Shipman read an interesting report of a Geological excursion made by the members on the 5th October to Froghall, Caldon Low, Weaver Hills, and Alton Towers. January 17th.—Mr. H. M. Ward gave a lecture on "Green Leaves."

SMALL HEATH LITERARY AND SCIENTIFIC SOCIETY, BIRMINGHAM.—The annual Conversazione was held in the Board Schools, Jenkins Street, on New Year's Day. A very interesting exhibition was made, including specimens from the South Kensington Museum, lent by the India Office; Microphone, Microscope, Dichroic liquid, Trap-door Spiders, &c., exhibited by Mr. Lawson Tait; a collection of Biological specimens, exhibited by Mr. Aaron Franklin; microscopes, revolving stereoscope, &c., exhibited by Miss R. Bailey; Circulation of Blood in Frog's Foot, exhibited by the President (Mr. Jacob Rowlands;) Collection of British Birds' Eggs, exhibited by Mr. C. E. Rowlands; specimens of Freshwater Life, exhibited by Mr. Thos. Bolton; and many other objects of interest, exhibited by various gentlemen. There was also an amateur dramatic performance.

EXCHANGE.

Will give good collection of land and freshwater shells for any volume of "Science Gossip." Want all volumes since commencement of publication. Also want "Turton's Land and Freshwater Shells," and other books on shells.—C. T. MUSSON, 68, Goldsmith Street, Nottingham.

THE PREDACEOUS WATER BEETLES (HYDRADEPHAGA) OF LEICESTERSHIRE.

BY G. ROBSON.

Whilst the sciences of Geology and Botany are favourite subjects of study with those who possess a taste for Natural History, very few care for working up, with anything like thoroughness, the science of Entomology, particularly some of the obscurer branches, such as the order *Coleoptera*. Botany is regarded as being a very beautiful science, and Geology has powerful attractions; but, Beetles! why the very name is too much for the sensitiveness of ladies, and even gentlemen shrink from handling them. Butterflies and moths have many admirers of both sexes, but Beetles, particularly Water Beetles, live almost totally undisturbed in their native habitats. A short account of some of the Water Beetles of the county of Leicester may, therefore, be of some use, and tend to excite an interest in these little creatures. I am sure this branch of Natural History would well repay the labours of any earnest worker. Very little seems to be known by the people generally about the *Hydradephaga* or Predaceous Water Beetles, in proof of which it may be stated that in all my rambles in search of specimens I never met with any, amongst the mass of those who stopped to look on, who could divine my object. The pursuit of Natural History is little appreciated by the common people. My vasculum has often been mistaken for a candle-box, and I am frequently asked questions like this—"I say, master, what have you brought your candle-box out for this warm day?" My answer has been—"Because we want more light."

I have been induced to look up the *Hydradephaga* of Leicestershire at the instigation of my friend and patron, F. T. Mott, Esq., F.G.S. Furnished with "Stephens' Manual of British Coleoptera," a water-net, killing-bottle, and other apparatus, all complete, I looked anxiously forward to the day when I could try my hand upon this, to me, new branch of Natural History. The hoped-for day came at last, and found me, with laurel bottle and net, and some misgivings mingled with my hopes, ready to take my way, guided partly by instinct, to those hunting grounds where I had many times before, with much pleasure, engaged in pursuits of a kindred nature. It was rather a cold morning in May when I started on my way to Anstey, and, the season not being very forward, my doubts as to my probable success were strengthened rather than dispelled. All animated things seemed to be still wrapped in their winter sleep, and, standing by the cold, glassy waters of the first pond I arrived at, I could not help a half shudder of hopeless feeling creeping upon me as I thought I should certainly fail in my new undertaking. There was, however, no help for it, but to try my best; so down I got to the water's edge, where I could obtain the most favourable sweep with the net. I watched the water drain through the net, anxiously asking myself—Is there anything in it? Yes, sure enough, there was—strange creatures, which, in all my boyish wading, I had never before seen.

Amongst other curious things were some of the beetles I had come to seek—a small species, with four light-coloured spots on the elytra, which I afterwards made out to be the common *Hydroporus palustris*. I was, however, much pleased with the insect at the time. The same day I caught several specimens of *Hyphydrus ovatus*, and one of *Dyticus marginalis*, and thought myself well repaid for my trouble. I learned one lesson from this first trial, namely, that laurel leaves are of no use as a killing agent.* So I obtained some cyanide of potassium, placed it in a bottle, and poured over it some plaster of Paris, to keep it in place and make a level bottom.

My next day out, which was in about a week after the first, was spent in the same district, but I extended my field of operations. Nothing very uncommon was met with this time, excepting *Hygrotus (Hydroporus) pictus*; several specimens of *Acilius sulcatus* also occurred, but this species I afterwards found to be common. I next tried the Charnwood Forest district, but soon discovered that if I wanted water-beetles I must keep in the valley of the Soar. After this, on every fresh excursion, my net brought up some new species. In the Abbey Meadow I first found *Hydroporus depressus*; from Barkby Brook were captured *Hydroporus 12-punctatus, (duodecimpustulatus,)* and *Colymbetes (Agabus) maculatus* and *nebulosus*—the latter being common in all clear water. Early in June I brought from the Anstey ponds *Haliplus obliquus*, *Laccophilus hyalinus*, and *Colymbetes fuscus*; from Thurmaston Sandhole, *Hydroporus planus* and *H. memnonius*. This last place yielded the rarest species, and, excepting the tributaries of the Soar, was the most prolific. It is a large extent of land from which ballast has been obtained, and is full of bright pools, which, as the summer advanced, became covered with a rich growth of *confervæ*. It was here I obtained the single specimen (of the season) of *Pelobius Hermanni*. I tried many times, but never succeeded in taking any more *Pelobius*.

As the season advanced, I became better acquainted with the particular habitats of the various water-beetles, and could almost tell at sight, by the appearance of the water, what species were likely to occur. I seldom found anything in black muddy ponds except *Colymbetes (Agabus) Sturmi* and *bipustulatus*, and noticed that all the brightly coloured and spotted beetles were found in running or clear water; thus I had *C. (A.) vitreus (didymus)* from Barkby Brook, and *C. (A.) maculatus* from a brook near Syston. I scarcely ever found many beetles in ponds where *Lemna trisulca* grew, but in those covered with *L. minor* I was generally very successful. In streams by which *Œnanthe* grew, bright beetles were plentiful. I do not know in what relation these plants stand to water-beetles; it might be only an accidental circumstance, but I always regarded these characteristics as signs. I never found *Laccophilus hyalinus* with *L. minutus*. The latter, which is the brighter

* Mr. Robson must have been unfortunate in the laurel he used: or, perhaps, he did not keep it dry. Good laurel, properly used, is certainly the best "killing agent" for Coleoptera, and it is to be hoped that Mr. Robson will try again. Cyanide of potassium is bad in many ways, but principally because it renders the beetles stiff and hard to set.—EDS. M.N.

coloured of the two, being found in the clear water of the Soar, amongst the *Œnanthe*, and the former in the Anstey ponds.

One of my best and most successful days was spent in the neighbourhood of Syston. It was there, in the tributaries of the Soar, that I first found *Colymbetes (Ilybius) ater*, *guttiger*, and *fenestratus*, although I afterwards found them plentiful all along the Soar, and also at Blaby, along with *Hygrotus (Hydroporus) confluens* and *Haliplus fulvus* and *flavicollis*. At the latter place I accidentally broke my net, and as I could not subsequently revisit the place, am unable to say what other species might have been caught. There is a deep hollow in the Anstey fields at one end of which is a wide pond overgrown with duckweed, except in the middle, where it is kept clear by the drainage. From this I always obtained good specimens, including, besides those already mentioned, *Hydrobius fuscipes*, *fulvus*, and *(Helochares) lividus*.*

Altogether I obtained some fifty species, but did not nearly exhaust the field, in which, no doubt, there is still good work remaining to be done. My experience taught me the important fact that whilst some species appear to be generally distributed others are only to be found in certain localities. Everywhere, for example, in clear water, I found *Helophorus aquaticus* and *granularis*, but *Hygrotus (Hydroporus) reticulatus* was confined to a pond in Glebe Lane, Belgrave, and *H. lineatus* to a pond at Blaby.

Hunting for the beetles, under the invigorating influences of fresh air and sunshine, was all pleasure; the real work began when I got them home. In the first place Water Beetles are most difficult to mount, and I should be glad of any hint that would enable me to improve upon my plan. I use gummed card, relaxing the insects by putting them either in a damp place or in water.† The cyanide would relax (and spoil) them if left in a long time. There is a strong contractility in the legs of the *Hydradephaga*, and this, combined with the position in which they are articulated to the body, renders them more difficult to mount than other insects. In naming my captures I found the species of *Haliplus* most difficult to make out, but, with the aid of the beautiful microscope belonging to the Leicester Museum, all my difficulties were gradually overcome. The species of this genus are all small, ovate and convex, mostly light testaceous in colour, and have their hinder coxæ produced behind into a large plate, the effect of which is to make the legs appear to be very wide apart. Many species of this and allied genera approach each other very nearly and require close examination and study before they can be separated. The descriptions in Stephens' Manual are, moreover, so short and vague that no student would be able to get on with that alone. A good and cheap Manual of *Coleoptera* remains to be written.‡

* These three beetles do not belong to the family *Hydradephaga*, but to the *Palpicornia* or *Hydrophilidæ*.—Eds., M.N.

† Both these plans are bad. If kept in the chopped-laurel jar the beetles would be perfectly relaxed and ready to set at any time. Cyanide must be avoided. —Eds. M.N.

‡ Cox's "Handbook of Coleoptera," 2 vols., 17s. 6d., would be a great improvement on "Stephens." It is the best published, and is used by all Coleopterists. See "Mid. Nat.," Vol. I., p. 180.—Eds. M.N.

In concluding these notes I would urge that none should be deterred from the pursuit of knowledge, even amongst the beetles of our ponds and streams, by any false notions of distastefulness for the objects to be studied. It is our want of knowledge that makes us dislike such things; the more knowledge we obtain respecting them the more interested we shall become, and, though we may not see beauty in everything, we shall certainly see it in Beetles.*

SYNOPSIS OF LEICESTERSHIRE HYDRADEPHAGA.

HALIPLUS:	
Obliquus, *Fab.*	Anstey Ponds.
Fulvus, *Fab.* (ferrugineus.)	Blaby and Thurmaston Sandhole.
Fluviatilis, *Aubé*	Anstey Ponds.
Ruficollis, *De Geer*, (fulvicollis.)	Common in clear ponds.
Lineatocollis, *Marsh.*	Common in clear ponds.
PELOBIUS:	
Hermanni, *Fab.*	Thurmaston Sandhole.
HYPHYDRUS:	
Ovatus, *Linn.*	Anstey Ponds.
HYDROPORUS:	
Reticulatus, *Fab.*	Glebe Lane, Belgrave.
Inæqualis, *Fab.*	Anstey Ponds.
Confluens, *Fab.*	Blaby.
Pictus, *Fab.*	Anstey Ponds.
Duodecimpustulatus, *Ol.*	Barkby Brook and Thurmaston Sandhole.
Depressus, *Fab.*	Abbey Meadow, Barkby Brook, Syston.
Dorsalis, *Fab.*	Common.
Memnonius, *Nic.*	Thurmaston Sandhole.
Planus, *Fab.*	Thurmaston Sandhole.
Nigrita, *Fab.*	Eventon, (muddy pond.)
Vittula, *Er.*	Blaby.
Palustris, *Linn.*	Common.
Lineatus, *Fab.*	Blaby.
NOTERUS:	
Sparsus, *Marsh.* (semipunctatus.)	Thurmaston Sandhole.
LACCOPHILUS:	
Minutus, *Linn.*	The Soar.
Hyalinus, *De Geer.*	Anstey Ponds.
COLYMBETES:	
Fuscus, *Linn.*	Anstey Lane Ponds.
ILYBIUS:	
Fenestratus, *Fab.*	Ayleston, Sileby, Syston.
Fuliginosus, *Fab.*	Blaby and the Soar.
Ater, *De Geer.*	Syston.
AGABUS:	
Bipustulatus, *Linn.*	In muddy ponds.
Chalconotus, *Pz.*	Kirby Moat, Blaby.
Sturmi, *Schon.*	In all muddy ponds.
Didymus, *Ol.* (vitreus.)	Running streams, Syston, Barkby.
Nebulosus, *Forst.*	Common everywhere.
Maculatus, *Linn.*	Streams, Syston, Barkby.
DYTICUS:	
Marginalis, *Linn.*	Common in ponds.
ACILIUS:	
Sulcatus, *Linn.*	Common in ponds.

* It is to be hoped that Mr. Robson will continue to observe the Water Beetles of Leicestershire. There certainly must be many more species, even of the *Hydradephaga*, to be obtained and reported.—EDS. M.N.

PARASITES OF MAN.*

BY T. SPENCER COBBOLD, M.D., F.R.S., ETC.

[*Continued from page 9.*]

The last two, or rather, I should say, three nematode parasites that remain for the Society's consideration are Ascarides properly so called. It has long been the habit of medical practitioners and others to speak of the obnoxious little threadworms as Ascarides, whilst they call the large roundworms Lumbrici. Both terms are erroneous and misleading. The true Ascarides are readily recognised by their three prominent lips, associated with a more or less uniform thickness of the body, and a short tail which is not finely pointed. The Oxyurides on the other hand have a spindle-shaped body, which is finely drawn out behind. Hence their generic name. As to the large roundworms, it was, perhaps, not unnatural that in early times they should have been called Lumbrici—on account of their general external resemblance to earthworms—but it is hardly necessary to remark that, as regards their internal organisation, they differ essentially from the setigerous annelids; whilst, with rare exceptions, the nematodes are unisexual, the oligochætous Terricolæ are hermaphroditic. In the minds of unscientific and non-professional persons the Lumbrici are not only still frequently regarded as genuine earthworms, but, from time to time, sensational paragraphs find their way into the newspapers asserting that live eels have been ejected by the mouth; these so-called "eels" being lumbricoid Entozoa. Thus it is that the undisciplined mind, incapable of correct observation, conjures up and gives expression to notions which, though uttered in times of comparative enlightenment, are just as absurd and untrustworthy as certain statements which I have previously referred to in this relation as occurring in ancient writings, both sacred and secular.

NEMATODA CONTINUED.

40.—*Ascaris lumbricoides*, Linneus.

Synonymy.—*Fusaria*, Zeder; *Lumbricus teres hominis*, Tyson.

Larvæ.—As vermiform embryos, (developed within the egg,) they attain a length of nearly $\frac{1}{100}$ of an inch. As sexually immature worms they have been found by Heller in man, *post mortem*, up to the sizes of $\frac{1}{8}$in. and $\frac{1}{2}$in. respectively. The intervening stages have not been traced.

Intermediate host.—Probably not necessary.

Experiments.—Davaine, myself, and others have frequently reared the embryos in water; and whilst still enclosed within the egg-shell the embryos have been kept alive by Davaine for five or more years. The administration of eggs by Leuckart to swine, dogs, rabbits, and mice gave negative results. Davaine

* Communicated to the Microscopical General Meeting, (Birmingham Natural History and Microscopical Society,) February 18th, 1879. On Dr. Cobbold's behalf Mr. Hughes exhibited specimens of *Ascaris lumbricoides*, and an example of *A. mystax* taken from the human body. A large *Ascaris megalocephala* was shown, in order to compare the human and equine lumbricoids; other roundworms from a chimpanzee, and also from a cat, being likewise exhibited. Mr. Hughes also exhibited, from his cabinet, a slide of ova of *A. lumbricoides*, put up at the General Hospital in 1863.

also employed eggs, containing the embryos, in a similar set of experiments on rats and dogs. He also introduced them into the stomach of a cow, in linen-covered flasks. Some embryos escaped their shells, but nothing further transpired. Leuckart's experiments on insects also failed. Numerous worm-feedings with allied species of Ascaris have given similar general results at the hands of Leuckart, Davaine, Verloren, Unterberger, and myself. Heller says that the first moult of the larva occurs within the egg itself; a second ecdysis taking place before the worm arrives at sexual maturity.

Remarks.—There is every reason to believe that infection commonly occurs by persons carelessly drinking water into which the eggs of the worm have been accidentally or otherwise introduced, and within which medium the embryos have been hatched during warm weather. Pigs being infested by the same worm, the water from streams or ponds in the neighbourhood of pigstyes becomes a dangerous source of infection when employed for domestic purposes. Local endemics are traceable to this source. Careful filtration of water containing larvæ, before use, would probably of itself be an amply sufficient safeguard against infection. The determination of the identity of Dujardin's so-called *Ascaris suilla* of the hog with *A. lumbricoides* of man is due to Schneider. The large lumbricoid worm of the horse *(A. megalocephala)* is an entirely distinct species. In consequence of the tendency of lumbricoid worms to wander, they frequently give rise to grave symptoms and severe suffering to the human bearer; and they occasionally cause death by perforating the walls of the intestine. This fact implies the possession of great muscular strength. In the year 1863 Mr. Hughes read a paper to the Birmingham Natural History Association, in which he described the remarkable contractile powers of *Ascaris lumbricoides*. Mr. Hughes and Mr. C. J. Bracey, (House Surgeon to the General Hospital,) acting together, placed living specimens of the worms in water, raised to a temperature of about 100° Fahrenheit. This had the effect of keeping the parasites alive for several hours, during which time they displayed remarkably vigorous movements, their bodies contracting violently.

Literature.—Standard Works. See also Heller *(loc. cit.*, "Midland Naturalist," Vol. II., p. 8.) In connection with sanitary questions, it may be useful to refer to my memoir "On Sewage and Parasites, especially in relation to the dispersion and vitality of the germs of Entozoa," in the *Medical Times and Gazette* for Feb. 25th, 1871, p. 215, *et seq.*

41.—*Ascaris mystax*, Rudolphi.

Syn.—*Ascaris alata*, Bellingham; *A. cati*, Schrank; *A. teres felis*, Goeze.

Larvæ.—As intra-ovular embryos, the early stages are developed whilst the eggs are still within the body of the parent female worm. After hatching, and a subsequent residence in the outer world, so to say, their passive transference to the ultimate host is attended with rapid growth and a final ecdysis. Leuckart has traced these stages of growth in the cat, in whose stomach specimens of the larvæ were found, measuring only $\frac{1}{25}$ of an inch. The final skin is cast when the larvæ are about $\frac{1}{3}$ of an inch long. From Hering's observations, it would seem probable that a period of three weeks is amply sufficient for the produc-

tion of sexual maturity after the larvæ have gained access to the body of the ultimate bearer. The bearer may be either man himself, or it may be a cat, dog, lion, or some other feline carnivore.

Inter. Host.—Not necessary.

Exper.—Leuckart and others have made direct feeding-experiments with the ova, but they have always been attended with negative results.

Remarks.—The determination of the identity of this worm with Bellingham's *Ascaris alata* rests with myself. In this matter I had to oppose the great authority of my respected friend and senior, Professor Leuckart, and I had also to overcome the opposition of Küchenmeister, who sought to throw doubt on Bellingham's original discovery, characterising the so-called *Ascaris alata* as merely a young worm, "if indeed," he added, "it were a worm at all." At length, due acknowledgment of the correctness of my views has been made; and no less than seven instances are now on record of the occurrence of this parasite within the human body. Historically, this entozoon possesses a special interest in the fact that it supplied Dr. Henry Nelson with the data on which his remarkable thesis was based. In this thesis an important advance was made in reference to our knowledge of the embryogenetic process undergone by the nematodes.

Lit.—Bellingham, *Dublin Journal*, 1839; Nelson, Phil. Trans., 1851-52; Heller *(l. c.*, s. 361;) Cobbold, *Lancet* for January, 1863, and in "Entozoa," p. 316, *et seq.*

42.—*Ascaris maritima*, Leuckart.*

Syn.—None.

Larvæ.—Unknown.

Exper.—None.

Remarks.—A solitary sexually immature specimen supplied Leuckart with the means of determining the existence of this worm as a distinct species. It measured about 1¾ of an inch in length. The specimen was discovered in April, 1865, by Dr. Pfaff, at Jacobshavn, near Godhavn, West Greenland. It had been ejected from the mouth by a child.

Lit.—Leuckart, Die menschlichen Parasiten, Bd. II., s. 877.

[TO BE CONTINUED.]

HARDINESS IN PLANTS.

BY F. T. MOTT, F.R.G.S.

W. E. (p. 53) asks the interesting, and not very easily answered question, "What is the cause of hardiness in plants?" The subject has been partially investigated by several German botanists, and a good

* When in the introductory remarks prefixed to my former communication I spoke of only "five more human nematodes" as remaining to be noticed, I had forgotten this comparatively unimportant species.—T. S. C.

account of what is known about it may be found in Sachs' "Text Book of Botany," p. 653. It appears that the capacity to resist frost may be due to several causes, either singly or in combination. Among these are:—1. The proportion of water to solid matter in the cellular tissue. 2. The chemical constitution of the solid matter and the cell-sap, which varies slightly in different species. 3. The proportion of foliage to roots, and of stomata to leaf-surface. 4. The more or less dense structure of the epidermal tissue. Plants are killed by frost not so much through the rupture of their tissues in consequence of the expansion of the water into ice, as was formerly supposed, but rather through the structural and chemical changes which take place in consequence of the normal proportion of water being removed from the cell-walls, the cell-sap, and the protoplasm. Death is due quite as often to the *thawing* as to the *freezing*. A rapid thaw will kill many plants which would have survived a slow one, because the water which has been separated from the other constituents of the vegetable substance may be *re-absorbed* if the thawing is sufficiently gradual, but cannot be re-absorbed if it is too sudden.

Take a cup-full of starch-paste. Freeze it into a solid mass, and then thaw it quickly. It will not return to the condition of paste, but will have become a soft sponge, with water in the interstices. So the cellular tissue of the plant, when its normal proportion of water has been once frozen out cannot always re-absorb it, or return to its original condition. The cells shrink, become disorganised, and unable to carry on the functions of life.

It is well known that some chemical solutions will freeze much more easily than others. River water is coated with ice sooner than sea water. In like manner the sap of some plants freezes, no doubt, at a lower temperature than that of others. It is almost impossible to freeze a moss.

The solid cell-walls and protoplasmic bodies contain "water of imbibition" as crystals contain "water of crystallisation." This water is held between the molecules of the solid by the force of cohesion. If the proportion of water is large as in succulent plants and young foliage, the force of cohesion is weak, and the water is easily separated. Hence such plants and foliage are less hardy than those of a denser and dryer nature. Again, some plants "transpire" or exhale watery vapour more rapidly than others. This seems to be a frequent character of plants indigenous to warm climates. To maintain the supply of moisture from the roots the soil must be damp and *warm*. In a climate where the soil becomes cold or frozen such plants would die from thirst.

Plants may become "acclimatised" by a gradual modification of some of their original functions, so as to adapt themselves to the average temperature of a new climate. The Portugal cabbage, (*Couve Tronchuda,*) which some years ago was a comparatively tender variety, is now much hardier.

A LEPIDOPTERIST'S NOTES ON THE SEASON OF 1878.

BY JOSEPH ANDERSON, JUN.

That the season of 1878 was but an indifferent one for the Lepidopterist seems to have been the general report; nevertheless, as is always the case even in the worst of years, some good species turned up in greater or less abundance. In the first place, the most striking circumstance was the almost total disappearance of *Colias Edusa*, whilst in 1877 it literally swarmed, appearing too in places where it had never before been observed. In one field, near Chichester, I could have taken double, nay, treble the number of clouded yellows than of the common whites—Brassicæ, Rapæ, or Napi; and, what is more, my brother and I, in this same field, captured the surprising number of forty of the beautiful variety to which Haworth gave the name of Helice. The specimens exhibit a great variety of tint, some being greenish white, others by daylight a rich primrose yellow; in the size of the marginal spots also there is much diversity, in some they are reduced to the merest specks. The central spot in the hind wings varies from bright orange to cream colour, in nearly every case the whitest insects possessing the most deeply coloured spots. I saw but one Edusa throughout last year, and that was on the 25th October. Truly, the species of Colias are most erratic in their movements. This strange appearing and disappearing, however, is not confined to Colias; we may find the same taking place with many species—such as Cardui, Stellatarum, Convolvuli, &c. What is the reason? Possibly the same that causes the seeds of divers plants to remain for years dormant in the soil, and then suddenly to spring forth into rank luxuriance—the fortuitous combination, namely, of certain external circumstances—as moisture and heat.

The past year will certainly be noted for some very successful working in the fen districts of Cambridgeshire, such rarities as *Meliana flammea*, *Nonagria brevilinea*, and *Hydrilla palustris*, having been obtained in some numbers. Several specimens of the beautiful *Dianthœcia albimacula* were captured at Folkestone, and *Pachnobia hyperborea (carnica*, Heer, Newman,) in the locality where it occurs in Perthshire. These are only a few instances of the "plums" which fell, not into the mouths, but into the nets of the more fortunate collectors. I cannot myself boast of such captures, my collecting having been confined to the immediate neighbourhood of this place—Chichester; still, I am induced to think that a record of my own experience may not be without interest to others.

I may mention then first a beautiful buff variety of the small copper butterfly, *C. Phlæas*. The larvæ of *Vanessa Polychloros* were excessively abundant on elms in our garden. On one little bough which I broke off I counted as many as fifty. Some of these produced imagos of a remarkably dark and handsome tint, with the first spot on the costa not suffused as is usually the case, but divided into two circular spots, the

insect, save that it wants the yellow legs, bearing a great resemblance to the continental variety *Xanthomelas.* Perhaps some may not have noticed the liability to variation in the spots on the hind wings of *Cynthia cardui.* One which I took on the wing last July has a bright white pupil in one of the spots on the left lower wing, and in another the spots amalgamate in such a manner as almost to form a band. This butterfly and *Vanessa Atalanta* were as common as any during the past season. In one corner—and in that limited situation only—of a field where they were discovered many years since by my friend Mr. Jeffery, *Lycæna Alsus* was tolerably plentiful when we visited it last Whit Monday. Here were to be seen also, in almost as confined an area, any number of the lovely *Ophrys apifera* and *Orchis conopsea* in full flower.

During June and the first week of July I bred eight fine *Acherontia Atropos* from larvæ found in the preceding autumn, and in the first week of October I obtained three equally good imagos from larvæ found in July. All of these were very noisy insects—one especially, which squeaked in the three stages of its existence. With one exception they emerged between five and seven o'clock in the evening.

Geometers were by no means so plentiful this season as last. I can record no good species, the best being *Anticlea rubidata, Phibalapteryx tersata, Asthena luteata, Timandra amataria,* and *Acidalia emarginata.* Mr. Jeffery took several *Selidosema plumaria,* and a splendid melanic variety of *Boarmia abietaria.*

My sugaring operations were confined to the trees surrounding the house, my visitors to the sugary feast prepared for them including *Grammesia trilinea* and *Miana strigilis,* (very abundant,) the latter in every variety. Of the Mianas, indeed, I captured all except *Photedes captiuncula. Bryophila glandifera* came sparingly, but one was a pretty variety, having the upper wings powdered thickly with shining metallic scales of a bright green. *Dipterygia pinastri, Orthosia upsilon, Caradrina cubicularis, Caradrina blanda, Hadena oleracea, Amphipyra pyramidea, Anchocelis lunosa, Miselia oxyacanthæ, Acronycta rumicis,* and *Mania Maura,* were tolerably common; *Cosmia diffinis, Cosmia affinis, Agrotis puta, Noctua plecta,* and *Xanthia cerago,* less so. Of the gaily coloured *Catocala nupta* several put in an appearance for many nights together, and of *Agrotis saucia* I secured a good series both of the type and varieties. My most successful evening, however, was that of August 23rd, when I had the good fortune to "box" a fine *Leucania albipuncta.* The instant the light was thrown on the tree it fell to the ground, and I feared was lost; but on my second round, to my great delight, there it was again, and the next moment safely deposited in my poison-bottle. The "ignobile vulgus" *Anchocelis pistacina, Phlogophora meticulosa, Tryphæna orbona, Tryphæna pronuba, Leucania pallens,* with many others, mustered in full force even on the coldest nights.

Perhaps after this severe weather we may not be wrong in anticipating a good season for Lepidoptera next year, as it seems to be the general opinion that cold, hard winters, are more favourable than warm ones to the subsequent development of vegetable and insect life.

Reviews.

The Geology of East Somerset and the Bristol Coal Fields. By Horace B. Woodward, F.G.S. Nine plates, twenty-three woodcuts, 271 pp. Price 18s.

This Geological Survey memoir contains the results of the re-survey of a country which has long been classic ground to geologists. It was first mapped about thirty years ago by De la Beche, Ramsay, Phillips, and others. The revision of the Bristol area (sheet 35) was done by Mr. Bristow in 1864, whilst that of the southern part (sheet 19) is chiefly the work of Messrs. H. B. Woodward, Blake, and Ussher.

The area described includes a wonderful variety of formations, ranging from the Silurian Rocks of the Tortworth district, which may be regarded as a continuation of the Malvern and May Hill ridge, up to the Cretaceous Rocks, which come on in the south near Chard, and in the south-east at Mere, &c.

The physical features of the country are then described. The Severn and Bristol Channel form the western boundary; while on the east we have the Oolitic escarpment, rising to a height of about 800 feet. The principal rivers are the Little Avon, Bristol Avon, Yeo, Axe, and Parret.

The Old Red Sandstone rests upon the Silurian Rocks near Berkeley. It also forms the central axis of the Mendip Hills, rising at Blackdown to 1,067 feet above the sea-level.

The Carboniferous system is much more extensively developed. The Mountain Limestone has a thickness of 3,000 feet. From the north of Bristol, at Chipping Sodbury, it curves round to the west by Thornbury and Clifton, where the remarkable gorge cut by the Avon is well known. Thence it passes southwards by Backwell and Brockley Castle; turning rather abruptly to the east it forms the greater part of the Mendip Hills, which may be considered to extend from Uphill on the Bristol Channel by Axbridge to near Frome. The scenery of this southern portion is bare and rugged, with remarkable combes and ravines, as at Cheddar, Burrington, &c. Fossils are numerous, especially brachiopods, crinoids, and corals, the latter resembling those which form the fringing or shore reefs of the present day.

The Millstone Grit or Farewell Rock is on an average 1,000 feet in thickness, but in the Mendip district becomes reduced to half this amount. The Coal-measures proper comprise one main tract—the Bristol and Radstock coal-field—and two smaller basins which lie westward of it, viz., the Nailsea basin and that of Clapton-in-Gordano, which has lately been found to extend northwards under the Severn. Mr. Woodward also shows the great probability that a covered-up coal-basin exists south of the Mendips, about Wedmore, Glastonbury, &c., whilst eastwards such a series of basins probably extends by Oxford and the neighbourhood of London to connect with the coal-fields of Belgium and the north of France. The Bristol Coal-measures exhibit three well-

marked divisions—an *upper series*, about 2,000 feet thick, containing sixteen coal-seams, and a *lower series*, 2,500 feet thick, with twenty-six coal-seams. These are separated by a thick mass of sandstone, 2,000 feet thick, called the *Pennant Grit*, which contains only two or three thin seams. Altogether there are twenty seams which exceed two feet in thickness, producing an aggregate thickness of from seventy to one hundred feet of workable coal. The production is about one million tons per annum, at which rate of consumption the coal within a depth of 4,000 feet would last for 4,219 years.

The Permian Rocks are absent, and so are the Bunter Beds. The Keuper marls consequently rest directly upon the Coal-measures. They are about 800 feet thick, and the well-known bed, known as the dolomitic conglomerate, forms the base. The Penarth or Rhætic Beds are well exposed; they obtain a maximum (for England) thickness of 150 feet near Castle Carey. A valuable list of British Rhætic Fossils is also given. It includes three species of mammals, seven reptiles, thirty-one fishes, seven insects, four crustaceans, two annelids, seventy-five mollusks, four echinoderms, two corals, and three plants.

The Lias is very fully described. It is not in this area of great thickness, (not exceeding 800 feet,) but palæontologically is very interesting. The Midford Sands, classed by Professor Phillips with the Oolites, and by Dr. Wright with the Lias, are considered by Mr. Woodward to be true passage beds, linking the two great formations together.

The Oolitic Beds of East Somerset have long been famous for the excellent building-stone they furnish. The Inferior Oolite is quarried at Doulting, near Yeovil, and at Ham Hill. The chief quarries in the Great or Bath Oolite are at Corsham, Combe, Bath Hampton, Farley Downs, and Box. We mention these places, as it is usually possible to ascertain from the workmen on any new building where the stone comes from, but not so easy to obtain a reference to its exact geological position.

The alluvial deposits are also described at length. Bath bricks we note derive their name from the discoverer of their manufacture, a Mr. Bath, of Bridgwater. They are made from the slime of the river Parret. A good account is given of the minerals of the district, of its caverns, water supply, fissures, faults, cliffs, combes, and coast. Mr. Rutley describes the igneous rocks, which are illustrated by five beautiful plates (three in colours.) Lastly, there is an appendix prepared by Messrs. Woodward and Whitaker, including no fewer than 750 titles of papers which have been written on the Geology of Gloucestershire and Somersetshire.

Altogether this work does Mr. Woodward great credit. By the judicious use of large and small type he has been able to classify his information in a way which shows great mastery of detail, combined with method and power of generalisation, qualities which are indispensable to the field geologist, and which are not less necessary to the writer who undertakes to make known to the public the results of original research of a nature so complicated as those which we have here

clearly set before us. The price of the work compares favourably with that of several Survey memoirs lately published, a fact which we suspect is also owing to the author's care in the preparation of his manuscript, so as to avoid those subsequent alterations which add so greatly to the cost of printing. It was said of Sir Roderick Murchison that he "wrote in type," and it may be that some of the officers of the Survey imitate their late illustrious leader in this respect.

W. J. H.

Botanical Locality Record Club. Report of the Recorder for 1877, with Quinquennial Appendix, 1873-7. London: West, Newman, and Co., 1878.

THE part now issued completes the first quinquennial volume of the Reports of this Club, and appended to it is a summary of all the new county-records published by the members of this and the Botanical Exchange Clubs, up to the end of 1877. The five reports and appendix will form a volume of 308 pages, containing a mass of information upon the horizontal and (occasionally) the altitudinal range of British plants, additional to that comprised in Watson's "Topographical Botany." The greater part of these additions has its origin in the breaking up, since the time when the details of that work were collected, of many of the old so-called variable species into numerous "segregate" forms, the distribution of each of which required investigating afresh. But, besides these, there are, in fact, new county-records for such plants as *Campanula rotundifolia* and *Mercurialis perennis*, in cases where (*e.g.*, in South Somerset and Leicestershire) one would have thought there must have been abundant evidence of their occurrence. This serves to show that there is still work to do before the distribution of common and well-marked species will be fully known, to say nothing of the newer segregates, in regard to which little has yet been done.

By some the utility of such investigations is doubted, and it may be, perhaps, admitted that there is very little probability of any practical result from them, but still enquiries of this kind throw light upon questions of great geologic and biologic interest, and on that account approve themselves to those to whom the pursuit of knowledge, merely as knowledge, is fascinating. The theories of Edward Forbes upon the succession of Floras in Great Britain, and the classification of the British plants into *types* by Hewett C. Watson, are very little known to the average botanical student; but that is, I apprehend, owing to the absence of any ready access to them. So long as this knowledge is shut up in books which can be obtained only with difficulty, it is scarcely possible to expect any wide-spread acquaintance with it. Mr. Watson at one time complained that "there are hardly fifty botanists in England who sufficiently comprehend the philosophy of plant-distribution to take any living interest" in the work which the Record Club pursues. This estimate is, of course, now far too small, but the number would be much increased if there were more easy means of learning what is already known or imagined concerning the "philosophy of plant-distribution."

There is a reflection which cannot but be forced upon the mind of one who reads these reports, even if he has not already come to the same conclusion from his own experience, in regard to the minute differences of many segregate species. The botanical world is divided into two great camps, each other's mortal foes, the "Lumpers" and the "Splitters." The latter discovered the inconsistency of many of the views held by the former about species, and there is no doubt their discovery was a genuine one. But in their anxiety to avoid one extreme they have, not unnaturally, fallen into another. To prove this, one has only to observe the divergent conclusions often arrived at by two equally competent "authorities" anent a common bramble-bush, or any of the other puzzling genera. The cause lies in the supposed necessity of assigning a name to every specimen which may be collected, and when, as happens now and then, some unusually perverse plant will not fit in with any described species, and the discoverer has not sufficient weight to force a new name upon it, it must forsooth be assigned to that to which it comes nearest. And of course different botanists may, and do, hold different opinions on that point. Many examples of this may be found in the pages of these reports, but the members are slow to adopt, or at least to express, the natural conclusion, namely, that these segregates are often only a selected few out of a continuous chain of forms.

No botanist now believes in the old theory of fixed species; all admit that Variation *has* acted to produce the many diverse types of plants. But, if so, it is still acting; we know that when two species are separated by well-marked differences, it is only that the intermediate forms have disappeared, but there are cases in which the intermediate forms have *not* disappeared, in which species are forming under our very eyes. When we gather a Ranunculus, or an Hieracium, or a Rubus, which does not agree with any of the forms selected to be honoured with the title of species or sub-species, instead of doing violence to nature by (more or less arbitrarily) fixing on a name for it, we should rather admit the fact as it stands before us. As an example of what I mean, I will take a simple case. The old *Glyceria fluitans* is now divided into two species, *G. fluitans* and *G. plicata*, which differ considerably in some respects. But there are also found certain intermediate forms, to some of which the name of *pedicellata* is given, and these are ranked as a variety of *fluitans*. A very slight search will, however, enable one to find some form which agrees entirely with none of these three; yet according to present practice nine out of ten botanists would inflict one or other of the names upon it.

Somewhere may be read:—"A few naturalists deny the existence of those intermediate forms which the theory of Variation requires; but practical field-workers know that they exist, and are a puzzle and a torment to the collector." This is a false view; they are no torment when their true meaning is recognised, and we give up the vain attempt to bind infinite Nature in our narrow bonds of "described species." In the minute investigation of these varying forms lies the key to much that now puzzles us in the theory of Variation.

The Botanical Locality Record Club has during the last two years been making efforts to extend its work to the lower

Cryptogams, for which purpose it has already published a "Catalogue of British Mosses," (a second edition of which will include the Hepaticæ,) and, in the last report, a preliminary list of stations for the Characeæ. What is required is more members who will take up this branch of enquiry. It is probable that, for the purpose of the investigations of which these county-records are intended to form a basis, the lower Cryptogams will furnish more reliable data than the Phanerogams as being less directly influenced by human agencies.

The "Recorder" also proposes a scheme for future work in the publication of a series of maps, indicating by colouring the counties in which each of a selected number of standard species occurs as a native, thus "fixing types of distribution on the brain through the eye." It is intended, if possible, to publish them with the yearly reports, and it is to be hoped that this plan will be carried out. "Concurrently with such illustration of distribution would come a partitioning of our native British Flora into squads—Geographical Allies, presenting striking points of agreement in comital range." For instance, the "Recorder" says that *Cerastium arvense*, *Centaurea Scabiosa*, and *Echium vulgare* have, in West Yorkshire, "an almost identical horizontal distribution," but he doubts, and with reason, whether the same will hold good of all other counties. The subject is one which will furnish abundant scope for further enquiry.

Finally, while congratulating the "Recorder" upon the improvement in the later reports, which shows that the errors of the earlier ones have been carefully taken to heart, it remains only to recommend the Club earnestly to those botanists, who, having time for the work, desire to have some object in view to supply a constant stimulus to their labours, by showing them "what there is to do, and how they can help to do it." The former objections against the members, that they were mere "conscienceless grubbers-up of rarities," or "a kind of Co-operative Society for the repetition of already published plant-stations," have been disproved, if they ever required disproving, by the really useful work which the Society has done, and the way in which it has done it.

W. B. Grove, B.A.

On the Real Character of the Early Records of Genesis. By the Rev. Rayner Winterbotham, M.A. London: W. B. Whittingham and Co., 1878.

This excellent little pamphlet is written evidently with a sincere desire to smooth the difficulties which beset the subject; better still, the writer has shaken himself free from the fetters which usually clog the well-meant but futile efforts of his fellow-workers in the same field, and boldly accepts the established truths of Science. He recognises the importance of these early records as lying at the root of Old and New Testament theology. Also, that their "extreme difficulty" "exposes them to assaults, made in the name of Science, which are, to a large extent, unanswered and unanswerable."

Christians, happily, no longer oppose Science. It is freely admitted that God reveals himself in the Book of Nature as truly as in the Book of Revelation, and any apparent conflict between the two records is owing to misinterpretation. Many teachers of the Faith, nevertheless, unaware how well-founded are the conclusions of Science, shelter themselves under the conviction that scientific opinion may change in the direction they desire; but their ground is untenable. "Some of these well-established conclusions cut right across the statements" of the Mosaic Record "as generally understood, and we ought to face the fact." Two instances are given as types—the Creation of the World in six days and the universality of the Deluge of Noah.

Geology has plainly proved that the present order of things was brought about only after the lapse of vast ages, and all the plausible attempts to torture the Mosaic narrative into meaning something different from its literal sense, which might make it and the geological record agree, have had, one after another, to be abandoned.

The universality of the Deluge, and the utter destruction of animal life outside the Ark, are plainly asserted, but scientific evidence disproves the statements. The fact that the quadrupeds of "Australia are marsupials, and are the only marsupials in existence saving one family in North America," is convincing. "Will any one maintain that the ancestors of the marsupials of Australia really came out of the Ark?" "Journeyed together across land and sea from Ararat, nowhere settling, nowhere breeding, until they (and they alone) reached their future home?" Probably no one acquainted with Natural History believes that the Noachian Deluge was more than local, confined, it may be, to the tract inhabited by a particular race of Man. The evidence that man antedates the antiquity assignable to Adam and Eve "as historical personages" is fairly conclusive; and that difference of language existed long prior to the Tower of Babel Science has proved.

The solution of the difficulty suggested by the writer is that, as in all other histories, the earliest sacred records are told in mythical form. This, in no respect, necessitates the rejection of their *inspiration*. "Is it not at least possible," he asks, "however strange at first sight, that the Holy Spirit should have employed *myths* in the first instance, even as He employed poems, parables, visions, in other places?" Grant that the early Biblical Record is mythical, and the conflict with Science ceases. "Science and History are left in possession of the territory which belongs to them;" "Faith and Religicn are left in undisturbed sovereignty within the domain of moral and spiritual truth." "It would be folly to say there is no element of historic truth in the first ten chapters of Genesis. Unquestionably there is, only that element is not distinctly assignable." As to where myth ends and history commences, our author considers there is abundant evidence.

We regret our space forbids our following the argument further, but we trust the foregoing will awaken the interest of our scientific friends, and induce them to read the pamphlet carefully themselves.

S. S. R.

Microscopy.

Micro-fungi and other Microscopical Preparations.—The Editors of the "Midland Naturalist" have placed in my hands for examination a series of beautiful microscopical objects, prepared by the Rev. J. E. Vize, of Forden Vicarage, Welshpool, and I am able to say that they are very neatly and artistically mounted, and present quite a pleasing appearance in one's cabinet. The medium in which the objects are preserved is one well adapted for displaying their minuter structures, and is evidently well suited for these organisms, as it does not deteriorate with long keeping. Similar preparations by Mr. Vize which I have had in my possession for a long period look as well now as they did when first prepared. But Mr. Vize's preparations are not merely beautiful objects for the microscope, they not only gratify the eye by the great variety of form to be observed in them, but also possess the higher merit of being truly educational. All that I have examined are type specimens, and will serve the tyro in science as reliable guides to specific identification.

The Micro-fungi Mr. Vize has made a specialty, and speaks with authority on this branch of botanical science. Hence such preparations emanating from him will have a permanent value, and be of constant service as reference slides. In mosses, lichens, algæ, and hepaticæ I believe I am right in stating Mr. Vize does not depend upon his own judgment, although I know that he has done good work in some of these, but he has his specimens from our best British and Continental authorities. Hence in these cases also the slides will be reliable as type specimens.

Apart from their value, too, in this respect, many of these preparations will be valuable and instructive to the biological student, and will serve well to illustrate some of the phases of cell development. The reader of Sachs' "Text Book of Botany" will better appreciate some portions of the text of that work after an examination of some of these preparations than he could do from the study of woodcut illustrations, however carefully drawn. For instance, one of the objects at which I have just been looking, viz., a section of *Peziza badia*, shows at a glance the whole process of free cell formation. The sections are well cut, being sufficiently thin to show well with the ¼ or ⅛ objectives every detail. The moss preparations are also very good; they are thoroughly clean, and have evidently been treated with the reagents necessary for bringing out the details of cell structure, a matter of great importance in this study; and have been made so delicately transparent that the spores may be seen, perfectly, through the walls of the capsule. As objects for black background illumination, with low powers, these moss slides are truly beautiful. As I have had much experience in similar preparations, I can say with truth that to prepare these objects in so able a manner requires both skill and patience.

The following is an enumeration of the slides submitted to my notice.

Mosses.

Fissidens bryoides, showing perfect plant; leaves dissected from stem to show barren flower, capsules, peristome, and operculum.

Tortula mucronata, leaves dissected from stem and stem sections.

Jungermanniæ.

Frullania Tamarisci, whole plant; beautiful object for black back-ground illumination.

Lichens.

Phlyctis agelæa, section of hymenium, showing asci and spores.

Ricasolia læte-virens, a local species; section of hymenium, showing asci and spores.

Solorina saccata, similar section, showing asci, spores, and paraphyses in various stages of development.

Schizoxylon corticola, a very lovely object; rare; showing the granulose apothecia in various stages.

MICROFUNGI.

Arcyria punicea, section of capillitium and spores.
Endogone microscopica, showing vesicles; a very singular object.
Xylaria polymorpha, uniseriate spores and asci.
Patellaria rhabarbarina, asci and spores; very beautiful.
Xenodochus carbonarius, showing articulated spores.
Myxotrichum chartarum, showing branched flocci and spores.
Triphragmium ulmariæ, showing trilocular spores.
Phragmidium bulbosum, showing echinulate spores.
Peziza badia, ,, *granulata*, *Ascobolus furfuraceus*, *Sphæria acuta*. ,, *acuminata*, — all sections of hymenium; showing asci, spores, and paraphyses in various stages of development.
Stegonosporium cellulosum, unilocular spores.
Peronospora infestans, (potato disease,) resting spores.
Puccinia conii, ,, *epilobii*, — spores in various stages of development.

JAMES E. BAGNALL.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF JANUARY, 1879.

BY W. JEROME HARRISON, F.G.S.

New Year's Day was fairly warm and fine, but in the evening the wind shifted to N.E., and a severe frost set in, which lasted to the 13th. On this day the wind shifted to S.W., (blowing hard,) and a rapid thaw took place. This, however, was not to last. On the 16th the wind returned to its old quarter; the thermometer again fell below freezing point, and frost continued to the end of the month. The continuance of easterly winds was very remarkable, with, in consequence, a high barometer. Snow fell heavily on the 3rd and 18th, but there were frequent falls of minute ice spicules and some snow as fine as sand. The rain-fall was decidedly below the average, not exceeding one-half the usual amount in many localities. It fell almost entirely as snow and sleet. The sun was hardly ever visible, in fact was never seen during the last eight days of the month at most stations. At Stokesay a solar halo was seen on the 1st, and a lunar halo on the 2nd. A mock sun, bright with prismatic colours, was seen at More Rectory at one P.M. on the 16th. Several deaths of human beings, from exposure to the cold, falling into snow-drifts, &c., have been recorded in the newspapers. So severe and protracted a wave of cold as that which has lately passed over us is considered to swell the death-rate greatly. Mr. Wetheral, however, writes, "It is a fact, so far as Worcester is concerned, that during the coldest weather fewer deaths took place than have been known at the same period of the year for a long time, in some parishes none whatever." Vegetation was extremely backward. In this respect January, 1879, was a marked contrast to the same month in 1878, in the first week of which the Rev. J. Caswell (see "Midland Naturalist," Vol. I., p. 77) found eighty species of wild-flowers in blossom near Birmingham. Mr. Caswell says of the present year: "The only species of plants I found in flower in the first week of January, 1879, were two, the common chick-weed and a few stunted specimens of the daisy." Small birds were either conspicuous by their absence, or came daily to be fed. From Shifnal the Rev. J. Brooke writes:—"The starlings and throstles have all left us; blackbirds came to be fed and remained; rooks dying unless fed."

STATION.	OBSERVER.	RAINFALL. Total for M. In.	Greatest fall in 24 hours. In.	Date.	No. of rainy d.	TEMPERATURE. Greatest ht. Deg	Date.	Great'st cold. Deg	Date.
GLOUCESTERSHIRE.									
Cainscross, Stroud	W. B. Baker, Esq.	3·00	1·45	2	4	50·0	15		
Cheltenham	R. Tyrer, Esq.	2·51	·94	1	13	50·1	1	12·8	12
Stroud	T. J. Coley, Esq.	3·50	1·02	2	8	55·0	1	12·0	12
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	1·60	·33	14	8	48·0	1	16·0	12
Woolstaston	Rev. E. D. Carr	1·54	·41	17	2	46·0	13	14·0	11
Leaton Vicarage, Shrewsbury	Rev. E. V. Pigott	1·47	·51	17	10	49·0	1 & 13	9·4	12
More Rectory, Bishop's Castle	Rev. A. Male	1·86	·48	2	13	52·0	14	10·0	12
Larden Hall	Miss F. K. Boughton	1·75	·35	17	10				
Bishop's Castle	E. Griffiths, Esq.	1·60	·30	17	12	47·0	13	15·0	11 & 12
Cardington	Rev. Wm. Elliott	1·88	·45	14	19				
Adderley Rectory	Rev. A. Corbet	1·77	·48	18	8				
Stokesay	Rev. J. D. La Touche	1·34	·45	17	7	49·9	1	8·2	6
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	2·67	·47	14	14			6·0	11
Stoke Bliss	Rev. G. E. Alexander	2·37	·53	17	13	46·0	14	17·0	11
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq	2·31	·54	17	10	49·5	13	10·0	12
West Malvern	A. H. Hartland, Esq.	2·89	·62	17	14	47·5	13	16·5	9 & 10
Pedmore	E. B. Marten, Esq.	2·16	·46	2	11	45·0	14 & 15	18·0	11
Longlands, Stourbridge	J. Jeffries Esq.	1·8[illegible]	·41	18	9	46·0	14	12·0	11
Stourbridge	Mr. J. Jeffries	1·85	·41	18	9	46·0	14	12·0	11
St. John's, Worcester	G. B. Wetheral, Esq.	2·06	·48	17	9	42·0		25·0	6
Dennis, Stourbridge	Mr. C. Webb	1·98	·52	18	8	44·0	14	7·5	12
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	1·82	·50	14	9				
Amblecote	Mr. J. Robins	1·80	·39	14	9				
Dudley	Mr. J. Fisher	1·55	·40	14	8	46·0	13	18·0	11 & 22
Sedgley	Mr. C. Beale	1·36	·40	17	8	44·0	14	19·0	11
Kinver	Rev. W. H. Bolton	1·97	·45	17	8	50·0	1	12·0	11
Walsall	Mr. N. E. Best	1·71	·38	18	7	42·0	14	21·0	22
Grammar School, Burton	C. U. Tripp, Esq.	1·74	s).41	8	10	53·0	1	15·0	6
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	1·59		17	8	45·0	14	13·0	11
Wrottesley	E. Simpson, Esq.	1·90	·50	14	8	51·5	1	14·3	11
Tamworth	W. Arnold, Esq.	2·00	s)·28	18	6				
Heath House, Cheadle	J. G. Philips, Esq.	2·24	·59	14	6	45·0	13	17·0	11
Alstonfield Vicarage	Rev. W. H. Purchas	2·00	·64	12	4	39·5	15	8·1	9
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	2·64	s)·69	15	11	48·0	14	19·0	11
Coventry	J. Gulson, Esq.	2·58	·68	18	10	45·0	14	18·0	12
Bickenhill Vicarage	J. Ward, Esq.	2·14	s)·54	18	9	42·0	2	20·0	
St. Mary's College, Oscott	Rev. S. J. Whitty	2·04	·45	18	10	49·1	1	17·5	23
Henley-in-Arden	T. H. G. Newton, Esq.	2·61	·69	17	10	46·0	14	15·0	6 & 12
Rugby School	Rev. T. N. Hutchinson	2·15	s).50	18	9	47·0	13	15·5	12
DERBYSHIRE.									
Buxton	E. J. Sykes, Esq.	2·38	·79	14	7	46·4	2	10·0	11
Stoney Middleton	Rev. U. Smith	1·41	·54	14	5	46·0	14	9·0	4, 5, 16
Brampton St. Thomas	Rev. J. M. Mello	1·28	·53	14	6	44·5	13	9·0	20
Fernslope, Belper	J. G. Jackson, Esq.	1·94	·55	14	8	44·0	14	17·0	20
Linacre Reservoir	C. E. Jones, Esq.	1·46	·49	18	5				
Willesley Gardens	J. Tissington, Esq.	2·26							
Spondon	J. T. Barber, Esq.	1·46	·47	17	7	44·5	1	15·2	
Duffield	Wm. Bland, Esq.	1·82			9				
NOTTINGHAMSHIRE.									
Tuxford	J. N. Dufty, Esq.	1·75				41·0	14	18·0	10
Hodsock Priory, Worksop	H. Mellish, Esq.	1·17	·36	14	14	47·8	13	6·3	4
Park Hill, Nottingham	H. F. J[illegible]son, Esq.	1·51	·44	14	7	44·3	14	20·0	5
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	1·56	·44	18	7			13·0	7
Ashby Magna	Rev. E. Willes	1·54	s)·34	18	10	40·0	1	15·0	22
Market Harborough	S. W. Cox, Esq.	1·82	s)·59	18	9	43·0	14	12·0	6
Kibworth	T. Macauley, Esq.	1·82	·50	18	10			20·0	
Town Museum, Leicester	W. J. Harrison, Esq.	1·33	·29	15	13	50·6	1	17·0	11
Belmont Villas, Leicester	H. Billson, Esq.	1·26	·24	18	9	45·8	14	17·0	11
Syston	J. Hames, jun., Esq.	1·04	·45	8	5	48·0	1	12·0	6
Waltham-le-Wold	E. Ball, Esq.	1·19	·36	14	8	44·0	14	18·0	23
Little Dalby Hall	G. Jones, Esq.	1·09	·36	14	6	45·0	14	13·0	10 & 23
Coston Rectory, Melton	Rev. A. M. Rendell	1·18	·35	14	9	44·5	14	6·5	6
Belvoir Castle	W. Ingram, Esq.	·96	·37	15	s) 9	46·0	15	15·0	6
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	2·27	s)·65	1	10				
Castle Ashby	R. G. Scriven, Esq.	2·15	·54	1	8	46·0	14	16·0	11
Kettering	J. Wallis, Esq.	1·92	s)·50	18	10	52·0	1	18·0	11 & 12
Althorpe	G. S. Groom, Esq.	1·67	·47	2	9	45·0	14	16·0	5
RUTLAND.									
West Deyne, Uppingham	Rev. G. H. Mullins	1·49	·40	14	9	44·8	14	17·7	11
Northfields, Stamford	W. Hayes, Esq.	1·31	·33	14	10	54·0	1	16·0	13
Radcliffe Observatory, Oxford	Mr. H. E. Bellamy	3·00	·98	1	9	46·8	14	16·6	12
Spital Cemetery, Carlisle	T. Bell, Esq.	1·18	·92	12	4	47·1	13	11·8	22
Ventnor Hospital	H. Sagar, Esq.	4·31	1·45	1	16	49·2	8	22·2	12
Altarnun Vicarage	Rev. G. Tripp	6·73	2·10	2	14	52·0	1	12·0	12

Correspondence.

RECTANGULAR PRISM.—Will some one kindly inform me where I can obtain the prism mentioned at p. 18?—W. H. C., Folkestone.

[Of Mr. James Swift, 43, University Street, London, W.; and probably any of the London opticians.—EDS. M. N.]

SNOW CRYSTALS.—The easiest way to examine these is to take the microscope into the open air. If snow is falling, place it under some screen, or get a friend to hold an umbrella over it. In a few minutes the instrument will be of same temperature as the air, and snow-flakes may then be caught on a glass-slide, held by a clip, (so that the warmth of the hand shall be kept at a distance,) and examined one after another.—H.

SNOW CRYSTALS UNDER THE MICROSCOPE.—An apparatus suitable for observations of this kind is described and figured in Sachs' "Text Book of Botany," p. 658. Perhaps a simple method would be to place a lump of ice in a saucer, close under the stage, and let the snow crystal fall upon a glass slip, whose temperature had been reduced to 32°.—F. T. MOTT, Leicester.

MOUNTING POLYZOA AND ROTIFERS.—Some of your correspondents (p. 52) enquire how Freshwater Polyzoa and Rotifers can be mounted. I have mounted them very successfully by the following process:—Place the Polyzoa in a deep cell with some of the pond water; let them remain undisturbed till they have expanded their tentacles, then suddenly let fall a drop of alcohol into the cell. This kills them instantly. The cell is then filled up with distilled water or glycerine, and sealed in the usual way. Rotifers may be treated in the same manner, but the cell may be shallow.—THOS. LISLE, Wolverhampton.

EARLY SIGNS OF SPRING.—A specimen of the Small Tortoiseshell Butterfly was captured in the garden of Mr. Lee, Sparkenhoe Street, in this town, on the 12th of February. On the same day the first Snowdrop opened its blossom in my own garden, Crocuses being an inch or two above the ground, Lilacs, Flowering Currants, and Deutzias showing green tips to their leaf-buds; and the Nuts (Fill-basket) putting out the red styles of their female blossoms. Laurustinus, Sweet Bay, and Magnolia have suffered slightly from the long frost, but less damage appears to have been done than I expected.—F. T. MOTT, Leicester.

CIRCULATION IN EMBRYO OF TROUT.—On Saturday, February 15th, I received from Mr. T. Bolton, 17, Ann Street, Birmingham, a tube containing the Embryo of the Trout in the "Alevin stage," accompanied by an admirable descriptive diagram, drawn by Mr. H. E. Forrest. This is one of the most beautiful and instructive objects for the microscope I have ever seen, and in my opinion is a far better subject for showing the circulation of the blood than either the web of a frog's foot or the tail of a tadpole, inasmuch as without the least trouble or preparation, beyond placing it in a small zoophyte trough, the whole system of circulation, from the heart to the farthest capillaries and back again, can be observed in the most perfect manner. The pulsative motion of the blood in the arteries, as distinguished from that in the veins, which flows in a steady, unvarying stream, is made patent to the most superficial observer. I have no doubt most of Mr. Bolton's subscribers derived very great pleasure from this interesting specimen, and, as I did, congratulated themselves on the result of their subscription to his microscopic agency.—JOHN F. GOODE, Handsworth.

UNUSUAL DEPARTURE OF BIRDS.—During the late hard weather the Fieldfares, Missel Thrushes, and Redwings quite left us, a most unusual circumstance. Up to the middle of December the first two were

plentiful, but after that they began gradually to lessen in numbers, and from the 1st of January to the 8th inst. (when I observed a small flock of about twenty of the former flying over) I did not see one. Redwings left earlier, about the second week in December, and I have only seen one (on the 11th instant) since. Song Thrushes have been very scarce, and Blackbirds not nearly so numerous as usual. We have had more berries on the trees this time than some years when the birds did not leave us. Have any of your readers observed a like migration of the Thrush family? It would, I think, be interesting to know if it was general, and if the birds left England or merely went south. Five Hawfinches and two Snow Buntings *(Emberiza nivalis)* have been observed here this season, the latter is a very rare winter visitor.—O.V.A., Bodicote, Oxon, Feb. 12.

THE ANCIENT INHABITANTS OF THE COTTESWOLDS.—In the neighbourhood of Cheltenham and Stroud there are distinct remains of the existence of four different races of men before the Roman occupation of the country. 1.—A small, long-headed race, not exceeding 5ft. 5in., occasionally discovered doubled up beneath a heap of earth or clay. 2.—A tall, long-headed race, exceeding often 6ft., found in round barrows, with central kist made of unhewn stone walling, and covered with slabs, several bodies being placed together in the kist. 3.—A mixed race, varying in stature from 5ft. 4in. to 5ft. 6in. or 8in. Their remains are found in the chambers of long or heart-shaped barrows. No traces of metal have been discovered in any of the above burial places. 4.—The remains of a short-headed athletic race. They are connected with the dressed stone kists, with cinerary urns, burned bones, and metals. The first race, the most ancient, may be represented by the Eskimos; the second race the same people, located under more favourable circumstances; the third race may represent the Ancient Gaels, who named the rivers and most conspicuous objects, and were the constructors of all the unhewn stone works at Avebury, Stanton Drew, &c., &c. The fourth race may be said to represent the Welsh Cymri, the Belgæ of Cæsar, or what are called the Ancient British. They introduced metals, practised cremation, and erected Stonehenge, and all the other dressed-stone works. They were followed by the Romans, &c.—HENRY BIRD, Bath.

GARNETS IN CHARNWOOD ROCKS.—Garnets are of frequent occurrence in metamorphic rocks such as gneiss, talc-schist, dolomite, &c. The best known British localities are the neighbourhood of Dartmoor, Botallack in Cornwall, and Saddleback and Keswick, in Cumberland. I have long felt rather surprised that this mineral could not be detected in the rocks of Charnwood Forest, and their absence in the coarse slates and grits seems confirmatory of the view so ably advocated by Professor Bonney and the Rev. E. Hill that these rocks have really not undergone very intense metamorphism, and that the crystals of felspar, quartz, &c., which they contain were ejected with the other material from volcanic vents, and are not products of subsequent alteration. To-day, however, in minutely examining some specimens I collected last summer, I was pleased to find many small garnets in the curious rock we call gneiss, which is found at one point only, viz., Brazil Wood, about half-way between Mountsorrel and Swithland. Here this gneiss is in contact (unless a diorite dyke intervenes) with the edge of the great granitic mass which forms Mountsorrel and Buddon Wood. In the specimen I have before me the garnets are very small, (not more than one-tenth of an inch in diameter,) almost black in colour, and so thickly crowded that there are about fifty in a square inch. It is possible that this gneiss may turn out to belong to a distinct series of rocks from those which form the rest of Charnwood Forest, but unfortunately it is entirely isolated by the surrounding red marls of the Trias, so that its relations to the slaty series cannot be traced.—W. J. HARRISON, F.G.S.

Microscopic Camera-obscura.—At page 18 an account is given of a method of drawing objects under the microscope, by means of a rectangular prism. This method has been in use for a long time. In "Science Gossip" for 1866, p. 233, the following full directions (which some of your readers may find useful) are given by Mr. Geo. W. Hart:—"I remove the cover of the eye-piece, and in place of the camera-lucida reflecting-glass I substitute a right-angled prism, fitted in a short tube, so that it can be placed close to or removed from the eye-piece for adjustment. I have had constructed a wooden frame, exactly like a box without a lid. Placing this on a table on end, with the open side next the observer, I pass the tube of the microscope through a slit in front, this opening being covered with a dark cloth to prevent light entering. I also nail another dark cloth on the top of the box, and allow it to fall over my head and shoulders; this should be large enough to enable me to use both hands. Now, placing the microscope horizontally, and putting on the tube so as to throw down a circle of light when the object is illuminated, the image will be seen beatifully defined on a sheet of paper placed in front of the draughtsman. When it is wished to make a coloured drawing, it is well to trace the outline, and then moving the paper a little on one side, colour the sketch to correspond with the image, which will then be reflected by the side of the tracing. I have used the camera in this form for many years, and have wondered that it has never been generally used."—F. Abell, Hampstead.

Aquaria.—At page 53, H. M., Derby, asks the best artificial food for freshwater fishes when the natural food, &c., is not easily to be procured. I beg leave to call his attention to vermicelli; nearly all freshwater fish will eat it and thrive thereon. Carp of all kinds take it greedily, especially the gold, tench, dace, roach, gudgeon, and minnows, &c. Vermicelli has the advantage of being clean, and not discolouring the water, as bread does if given too profusely. Of course a little change of diet is welcome when it can be got: small red worms or minced raw meat; mutton is best, but must be given very sparingly. White fungus on carp, roach, &c., is very troublesome, and I think arises principally from debility; the fish should be removed as soon as the disease is noticed to a separate vessel, if possible. I sometimes take the patient out of the water, wipe the fungus off with a silk handkerchief, then sprinkle with white sand, and return to the water quickly. The sand adhering to the fish causes it to rub itself against stones, &c., which is very beneficial. I have had fish quite recover after being treated in this way. I can strongly recommend "The Book of the Aquarium," by Shirley Hibberd, to the notice of H. M.; he will find it a handy little volume, and full of practical information, *re* Aquaria both Sea and Freshwater.—R. G.

Aquaria.—Your correspondent (page 53) will find that the small crustacea, aquatic larvæ, and worms, which may be taken by means of a fine net from nearly every pond, pool, or river, are excellent food for freshwater fish. If the tank is already sufficiently full of water, take some out, and then empty in its place the contents of the can or bottle containing your catch of small fry, when it will at once be observed that the fish have become very busy in making the acquaintance of their newly introduced friends, which they most greedily devour. The spawn of snails is also very good food, and may be readily supplied by keeping plenty of those interesting creatures as companions in the aquarium. Some keepers of aquaria are opposed to the introduction of artificial food, as bread, meat, or earthworms; but this will be found to answer well, if given in small quantities, and care taken not to leave any uneaten portion to decay in the water, which is probably the only source of

mischief. Carp, roach, and dace are very fond of bread, which should be pressed in the hand and made pasty, so that it will not fall to pieces when put in the water; drop in small pellets, if possible, not more than the fishes will take. I used to keep a number of carp, which always became excited when bread was on the table at meals, and would continue wriggling and swimming against the glass, as though they meant to come through, until I gave them a supply, which I never failed to do. A pair of wooden forceps which will reach conveniently to the bottom of the aquarium are exceedingly useful for removing either dead animals, or any other matter which requires to be taken out. I believe there is no cure for the fungus which attacks and destroys the fish, but it is highly necessary to remove at once any that may be so diseased, and to examine well all new specimens introduced to see that they are perfectly healthy.—J. L.

AQUARIA.—Some of your readers may be interested in the following facts:—I have a small bell glass aquarium, which, as a marine aquarium, has been very successful, there having been no deaths for upwards of two years, and the anemones have throughout maintained a high standard of vitality, attributable, I consider, to regular feeding, aeration, and scrupulous cleanliness. Numerous young have been cast off, and one stone is closely covered with what are apparently larval forms of the starfish. During this winter the anemones have been unusually errant in their dispositions, and I have three times, on different occasions, observed what seem to be conjugations. In each case the first sign was the appearance round the base of the animal of the spermatic cords, and these in some cases reach the length of an inch and a half. They float in the water, and that they are perceived by other anemones is proved by the animals moving up, and with their base partially covering the extended base of the first. They remain in this state for about twelve hours; the emission of the spermatic cords is increased till both are enveloped in the coils, which are perfectly visible, and between thirty and forty in number. At least I have counted as many. After some interval—about twenty-four hours since the first contact—the one that has moved up moves away, each closes, and remains in a state of quiescence, from which they do not emerge for some days, no matter how tempted by food or aeration. I shall be glad to learn if any of your readers have noticed similar occurrences.—G. L. B., Denmark Hill.

[We refer our correspondent to Mr. Gosse's "Actinologia Britannica," (Intr. pp. xxi.—xl., the Reproductive System and the Teliferous System,) and he will see that what he calls spermatic cords are the ordinary *acontia*, which have nothing to do with generation.—EDS. M. N.]

Gleanings.

PALÆONTOGRAPHICAL SOCIETY.—Mr. A. H. Scott White, B.Sc., B.A., of the High School, Nottingham, has been appointed local secretary for Nottingham and neighbourhood.

THE PHONOGRAPH.—The London Stereoscopic Company (who hold the sole patent) are now offering to supply Edison's speaking phonograph, to be worked by hand, at a price of ten guineas each, "subject to their non-exhibition for money payment."

GEOLOGICAL SOCIETY.—THE WOOLLASTON FUND.—We have much pleasure in stating that the Council of the Geological Society have unanimously presented to Mr. Samuel Allport, F.G.S., a former president of the Birmingham Natural History and Microscopical Society, the balance of the Woollaston Fund at their disposal in recognition of his researches on British Igneous Rocks.

MELICERTA TYRO.—Dr. Hudson thinks that the name of this rotifer should be changed to *M. Tubicolaria*, for a reason which we give in his own words: "I have now little doubt, in spite of the errors in his figures and description, that it was this rotifer out of which Ehrenberg framed his genus *Tubicolaria*."

ŒCISTES UMBELLA AND OTHER ROTIFERS is the subject of a most interesting paper by Dr. Hudson, in the current number of the "Journal of the Royal Microscopical Society." This is the rotifer figured by Mr. A. W. Wills, in Vol. I., "Midland Naturalist," p. 317, for which he there suggested the name of *Œ. longipes*. There are plates representing the above-named *Œcistes* and also *Conochilus volvox*.

ROYAL MICROSCOPICAL SOCIETY'S JOURNAL.—We cordially recommend our microscopical readers to become subscribers for this admirable journal. The current number, besides the paper above mentioned, contains one entitled "A further Enquiry into the Limits of Microscopic Vision," by Dr. Royston-Pigott, F.R.S.; one "On some Recent Forms of Camera Lucida," by Mr. Frank Crisp, LL.B. (Editor of the Journal;) and several others; more than fifty pages of "Notes and Memoranda," of great interest; and a most useful "Bibliography of recent Scientific Publications."

FORAMINIFERA.—Microscopists who study the Protozoa will be pleased to learn that a "Catalogue of Recent British Foraminifera" for the use of collectors has been compiled by Mr. J. D. Siddall, of Bridge Street, Chester, with the assistance of Mr. H. B. Brady. This useful compilation contains a complete bibliography of the order, together with a well-arranged list (founded on that propounded in Dr. Carpenter's "Introduction to the study of the Foraminifera") of the various families, genera and species. Blank spaces are also left for the collector's notes.

SCIENTIFIC SOIREE.—The learned societies at Liverpool held a very successful soirée last month at St. George's Hall, which was attended by over 3,000 persons. The large assembly had abundant material provided for their entertainment and instruction. Besides an almost endless display of natural history specimens, scientific and other objects of interest, there were several lectures delivered in different rooms by the Rev. W. H. Dallinger, Mr. Waterhouse Hawkins, Mr. James Birchall, and others, while in other rooms there were scientific experiments, concerts, &c.

GEOLOGISTS' ASSOCIATION OF LONDON.—We have received from this popular and useful society a copy of a new catalogue of their library, compiled with great care and fulness by the honorary librarian, B. B. Woodward, Esq. The headquarters of the association are at University College, Gower Street, London, E.C., where the monthly evening meetings are held. The great feature of the association's work, however, is the opportunity offered for field-work by the numerous excursions which take place during the summer under the direction of highly competent leaders, to points of geological interest in various parts of the kingdom. The terms of subscription are moderate—10s. 6d. entrance fee, and 10s. per annum—an outlay for which the printed "Proceedings" are alone a fair return. We are glad to see that the valuable services of Professor Morris, as director of excursions and as president, are to be recognised by a testimonial.

LICHENS.—We are able to announce that the Rev. W. A. Leighton has nearly completed the printing of the third edition of his Lichen-Flora of Great Britain, Ireland, and the Channel Islands, which, it is expected, will be ready for issue early this month. This new edition is rendered necessary by the surprising discoveries of Mr. Larbalestier in the West of Ireland; those of Mr. Crombie, Dr. Stirton, and others, in the North of Scotland; and Mr. Leighton's own researches in North and South Wales; whereby the Lichen-Flora of the former editions, amounting to 1,156, has been raised now to 1,706, thus rendering our lichens in number, rarity, and novelty quite equal to those of any country in Europe.

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

The Annual Meeting of the members of the Midland Union of Scientific Societies will this year be held at Leicester, on Tuesday and Wednesday, the 20th and 21st of May. On the first day there will be a meeting of the Council, the General Annual Meeting in the afternoon, and a Conversazione in the evening; whilst the chief feature of the second day will be an excursion to Charnwood Forest. Further details will appear in our next number.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—January 21st, MICROSCOPICAL GENERAL MEETING.—This meeting was made special for the purpose of considering the best steps to be taken to induce the members personally to assist in contributing to the Birmingham Reference Library Restoration Fund. The action of the committee in voting twenty guineas from the funds of the Society for that purpose was approved, and it was resolved that a circular, with a list of subscriptions already promised, and requesting further subscriptions, be sent to each member of the Society. A sub-committee was appointed to consider the question of the establishment of a Town's Museum, with authority to take action in conjunction with the other scientific societies. January 28th.—GEOLOGICAL SECTION.—Dr. Callaway, of Wellington, delivered an address on "The pre-Cambrian Rocks of Shropshire," in the course of which he gave the reasons which have led him to conclude that the series of devitrified pitchstones and volcanic agglomerates which form the axis of the Wrekin and of some other elevations in Shropshire, and the quartzite which flanks them, are of pre-Cambrian age. They probably correspond with the Pebidian series of St. David's in South Wales, as described by Dr. Hicks, and with the Huronian of Canada, and are more recent than the crystalline schists and gneissose rocks of Malvern, a patch of very similar character having been mapped by Dr. Holl as "burnt rocks" to the east of the Herefordshire Beacon. A vote of thanks was passed to Dr. Callaway for his interesting address. February 4th.—ANNUAL GENERAL MEETING.—The report and balance-sheet for the year 1878 were read and approved. The following officers were elected for the current year:—President, Walter Graham; Vice-Presidents, E. W. Badger and W. Southall; Treasurer, C. Pumphrey; Librarian, J. E. Bagnall; Curators, J. Levick and W. H. Cox; Secretaries, J. Morley and H. E. Forrest. The delivery of the retiring President's address was postponed to a future meeting, of which due notice will be given.—February 11th.—BIOLOGICAL SECTION.—Several microscopic objects were exhibited. Mr. W. G. Blatch gave some very interesting notes on the rare insects, chiefly Coleoptera, which he had taken during the past year. He alluded to the curious fact that severe winters seem to be more favourable to the production of rare insects during the following summer than mild ones, and pointed out that the coming season may, therefore, be expected to be a very rich one, entomologically speaking.—February 18th.—MICROSCOPICAL GENERAL MEETING.—Mr. J. E. Bagnall exhibited a number of rare mosses from Dr. Lindberg, among others *Dicranella Grevilleana*;

also some fine mosses from Mr. Cotton, collected near Barmouth. Mr. W. H. Wilkinson exhibited the white Christmas rose *(Helleborus niger)*, to show the tubular petals, which are assumed to secrete some fluid attractive to insects and so to serve as aids in fertilisation. Mr. Thomas Bolton exhibited the fine rotifer *Rhinops vitrea*, and a newly hatched Trout, showing the circulation of the blood both in the body and on the surface of the yolk-sac. Mr. J. Levick exhibited some remarkably large *Amœbæ*, and a free-swimming freshwater alga. Mr. W. R. Hughes, by request, re-exhibited six beautifully mounted slides recently presented to the Society by Mr. F. W. Sharpus. Mr. Hughes read the eighth of a series of papers on "The Entozoa and Ectozoa," by Dr. T. Spencer Cobbold, F.R.S., illustrated by specimens preserved in spirit, and a slide of ova of *Ascaris lumbricoides* put up at the General Hospital by Mr. Hughes in 1863.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY. —January 22nd.—Mr. C. J. Woodward, B.Sc., read a paper on "Spherical Projection applied to Crystallography." The different methods of projecting on to a plane surface the different points on a globe were first explained. A crystal was then defined as a body which has precisely similar properties in parallel planes, and it was shown that the various planes of a crystal were related to certain imaginary lines termed *axes*. The planes of a crystal might be considered each as touching a sphere in a point, and a map of these points constitute a spherical projection of the crystal. Reference was also made to symmetry in crystals, and some apparatus was shown to illustrate this branch of the subject. February 5th.—Mr. C. J. Watson gave a brief description of the phenomena of the Glacial Drift, illustrated by specimens and photographs. A resolution was afterwards passed that the members should take part in the examination of the drift deposits of the neighbourhood according to the scheme propounded by the Midland Union. February 12th.—Mr. J. T. Sprague, M.S.T.E., read a paper on the "Relations of Electromotive Force and Resistance to Current." In the course of it he said that it was much to be regretted that the British Association had used the word "resistance" to represent what was really only the reciprocal of conductivity. The term resistance should have been kept to express the work done in any part of the circuit, which varies as the square of the current passing. In consequence of this confounding of ideas essentially distinct much confusion existed in the minds of physicists as to the conditions under which electric force was really transmitted.

BIRMINGHAM PHILOSOPHICAL SOCIETY.—February 13th.—A paper was read by Dr. Saundby, on "Recent Metalloscopic and allied Researches."

BIRMINGHAM SCHOOL NATURAL HISTORY SOCIETY.—January 24th.—FIRST GENERAL MEETING, HALF-YEAR.—C. E. B. Hewitt having resigned his post as Hon. Sec. to this Society, H. F. Devis was elected Hon. Sec., *pro. tem.*, in his place. February 14th.—Paper read by A. B. Badger on "The proposed Union of the two Sections, Botanical and Entomological, under the name of the Biological Section." It was then proposed, seconded, and carried by a large majority, "That the Society comprise two Sections, for the study of Biology and Geology respectively." Mr. Turner was unanimously elected President of the Biological Section, and J. Chapman Curator.

BURTON-UPON-TRENT NATURAL HISTORY & ARCHÆOLOGICAL SOCIETY.—January 21st.—Mr. W. Molyneux, F.G.S., F.R.Hist.S., read a paper on "The pre-Norman History of Repton." After alluding to the grounds for thinking it had in turn been occupied by the Ancient Britons and the Romans, he next referred to the Saxon ecclesiastical foundation at Repton, in A.D. 653. He was of opinion that in the beautiful crypt there still remains a portion of the original edifice. A detailed description of the crypt was given. Mr. Molyneux further said that in dealing with the pre-Norman History of Repton it must always be borne in mind that the River Trent was at that time a larger river, and occupied considerably more space in the valley that it does now. It was navigable for boats, of what was then large tonnage, from its mouth at Gainsborough, over its main course as far as Stone, and over its two tributaries, the Sow as far as Stafford, and the Tame as far as Tamworth, a condition, he might add, by no means difficult of restoration. It was to these conditions that the Danes were

indebted for their successful attack upon the place, as they were enabled to ascend the river in fleets of vessels reckoned by hundreds in number. The same facilities were, of course, open to the early Britons and the Romans, and also to the Saxons; and there could be no doubt that the white sails and double oars or galleys of the two latter races were as frequently seen as those of the Danes. At this meeting were exhibited half a dozen specimens of the Death's-head moth, (*Acherontia Atropos,*) three male and three female, the larvæ of which were found last summer by Mr. George Baker, of Waterloo Street, feeding in his garden on *Lycium barbarum*, (the tea tree.) February 11th.—Mr. H. G. Tomlinson read a paper on "Birds and their Habits." After giving some interesting details as to the structure of birds and the varied ways in which the different kinds are fitted for their modes of life, some particulars were given about nests and eggs. Birds were next considered as divided into five orders—birds of prey, perchers, fowls, waders, and swimmers—the characteristics of each order being mentioned. Mr. Tomlinson then spoke of the habits of some of the birds frequenting Staffordshire and neighbourhood. Of birds of prey, the common buzzard was the largest seen there; the hobby-hawk was a rare summer visitor, but had been found at Dovedale; the kestrel, which might be known by its hovering in the air when in search of food; and the sparrow-hawk, a brave little fellow, formerly used in the art of falconry. While speaking of hawks, he remarked, as a noticeable fact, that in all birds of prey the female was the larger. The reason for this was not obvious. With one exception, and that not British, there were no songsters in this class of birds. They had also in the neighbourhood the white or barn owl and the tawny or wood owl. Owls, in addition to having great powers of sight and hearing, have a noiseless flight owing to their external wing feathers being detached and made to curve outwards, so that the air can pass through them. Of the perchers he first described the habits of the titmouse family, including the tom-tit, blue-tit, great tit, and long-tailed tit; the fly-catchers—spotted and pied—the kingfisher, the crow, rook, magpie, jackdaw, and jay; the tree-creeper; and the wood-pecker—the green or "laughing" wood-pecker being found at Bagot's Park and Bretby Park, and two other kinds—the lesser spotted and the greater—being occasionally found in the neighbourhood. Mention was made of the peculiarities of the cuckoo, one being that the young bird has an indentation in the middle of the back to assist it in ejecting from the nest in which it has been hatched the eggs of the rightful owner of the habitation, or its foster-brothers. This cavity fills up when the bird is about twelve days old, and the back becomes the same as that of other birds. The habits of the swallow, of which four species visit us; the wagtail, of which we have three varieties; larks and pipits, including skylarks and woodlarks; the buntings, of which we have the yellow-hammer; the finches, of which we have six varieties; the common brown linnet, the starling, the sparrow, the thrush, including the field-fare, red-wing, and missel-thrush; the blackbird, and a few others were also briefly noticed.—Mr. Tomlinson promised to continue the subject in another paper.

CHELTENHAM NATURAL SCIENCE SOCIETY.—February 20th.—Dr. Julius Maier read a paper on "The Spectroscope and its application to Solar Research," which was well illustrated.

NORTHAMPTON NATURAL HISTORY SOCIETY.—A meeting was held in December for the purpose of hearing a paper read by the Rev. Wm. Thornton, F.G.S., on the circumstances of the Liassic strata among the volcanic rocks of the West Highlands of Scotland. By request it was of an elementary character. It described the physical and geological character of Arran, the coast of Argyle, and more particularly Ardnamurchan Point, and the Cuchullin Hills, and Glen Sligachan in Skye. It was rendered the more interesting by being illustrated by a capital section of the coast of Skye, and some very high class water-colour drawings of Ben Cruachan, Glen Sligachan, &c. A hearty vote of thanks was awarded to the lecturer. Six new members were elected. Jan. 14th.—Mr. C. Jecks read a paper, entitled "A few Thoughts on Darwinism," in which Mr. Darwin's leading arguments were very clearly explained. Mr. Jecks referred to the insectivorous habits of certain plants, the electric power of the *Gymnotus*, &c. A discussion followed, in which the Rev. S. J. W. Sanders, the Rev. Canon Scott, and Messrs. Scriven, Eunson, and Druce, took part.

NOTTINGHAM HIGH SCHOOL NATURAL HISTORY SOCIETY.—Of this thriving society some very interesting particulars are given in the last number of "The Forester, or Nottingham High School Magazine," a publication of which, we may say in passing, the school may well be proud. It contains some capital papers, one in the number before us on "Mounting Insects as Microscopic Objects" being particularly good and practical. The Natural History Society consists of nearly eighty members, divided into sections, in which some good work is being done. Although only in its infancy, it possesses the nucleus of a good natural history library. At a recent meeting it was decided to offer prizes to the members for—(1) Type collection of British Phanerogamic Plants; (2) Collection of Minerals, Rocks, and Fossils, illustrating the geology of the Carboniferous formation, with especial reference to the neighbourhood of Nottingham; and (3) Type collection of British Insects. A lecture is delivered to the members every week, and the list of those announced for the present term is a most admirable one.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.—NATURAL SCIENCE SECTION.—January 24th.—Mr. G. B. Rothera, the president, read a paper on "The senses and their environment." February 14th.—MICROSCOPICAL MEETING.—Subject, "Comparative Anatomy and Physiology." Messrs. Burton, Jennings, and others showed specimens.

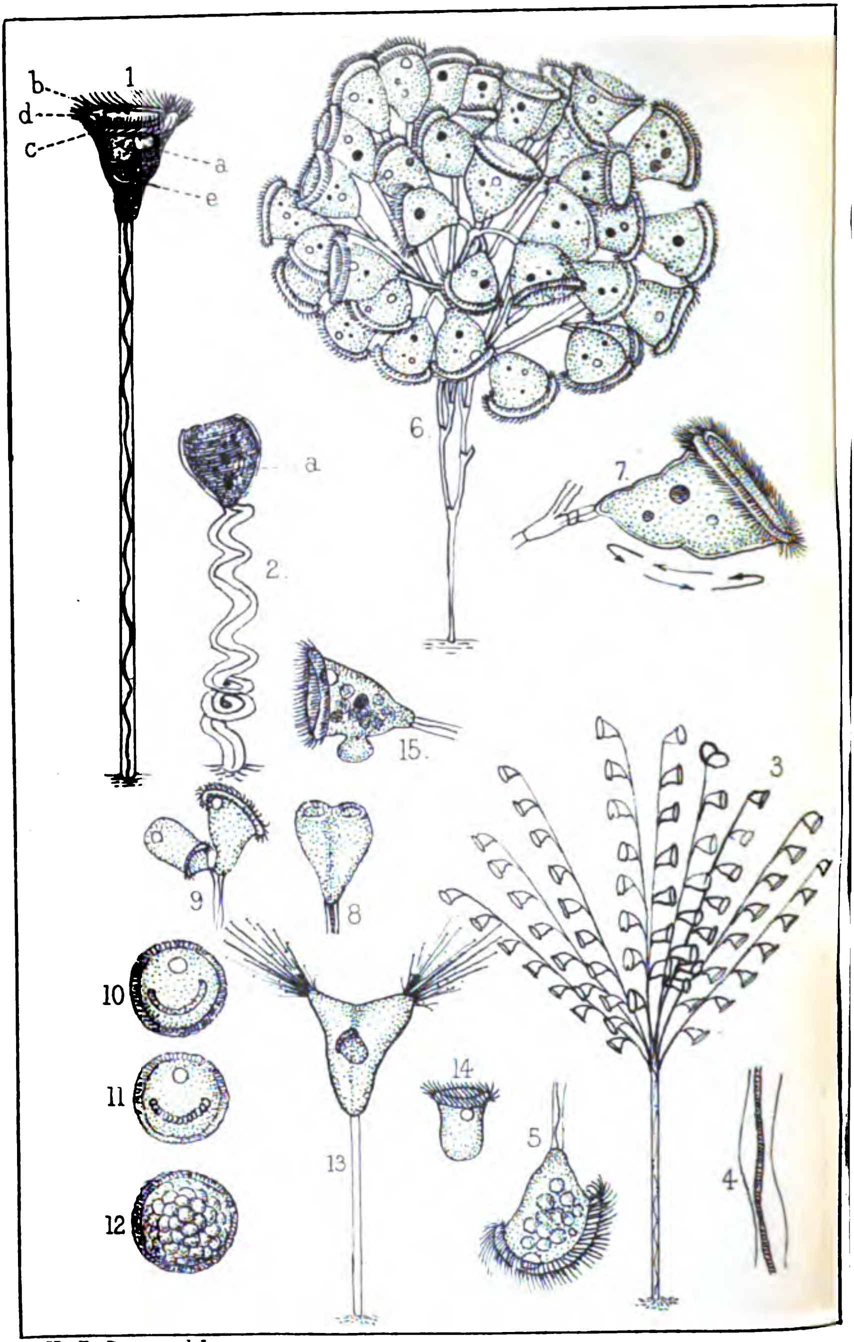
RUGBY SCHOOL NATURAL HISTORY SOCIETY.—February 1st.—Exhibited: Various Indian curiosities, by T. B. Oldham, (M.,) including bangles or hoops put round the arm by the Burmese. Papers: The President read portions of the Meteorological Section's Report for 1878; also, the Entomological Section's Report, 1878. T. B. Oldham (M.) read a paper, by his brother in India, on "The Growth of Shoots from the Roots." This paper arose from Mr. Cumming's note on the subject last term. A discussion followed. The President read a communication from W. E. Home (C.) on "The Royal Observatory at Edinburgh." The President read an anonymous paper on "The Zulus," describing their history and military organisation. February 15th.—Donations announced: Concise Glossary of Architecture and Introduction to Gothic Architecture, by J. H. Parker, C.B., F.S.A., from C. E. Sayle, (M.); Mediæval Sepulchral Antiquities of Northamptonshire, by M. H. Bloxam, Esq., F.S.A., (H.,) from the author; Roman Pottery, Tripontium, now Caves Hill, from T. B. Oldham and C. E. Sayle. Exhibited: Pencil Iron Ore, from Lydal-in-Furness, and Lias Limestone, Portrush, by E. Solly, (M.); a new form of the Telephone, or rather a Galvaniphone, by Rev. T. N. Hutchinson, (H.,) who explained the invention. It was used before the society. A distinct though non-articulating sound was audible to all, and it was pronounced a decided success. Papers: Mr. Bloxam (H.) read portions of a paper on some "Roman Sepulchral Slabs," now in a fireplace in Warwick Castle. Of these he exhibited a set of casts. He pronounced them to be mere "rough copies," from a Roman slab-cutter's yard, probably in Italy; R. D. Oldham (C.) read portions of a paper on some "Experiments to determine the Modulus of Cohesion of Ice, and their Bearing on the Glacial Erosion of Lake Basins." A considerable discussion followed. The President read a continuation of the paper on "The Zulus."

STROUD NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.—On February 11th, Mr. J. T. Fisher delivered a lecture on "The Solar and Stellar Systems."

EXCHANGE.

Wanted, a Vase, or any example of ancient British pottery, large or small, from a tumulus, earthwork, or other position; or a Roman or Romano-British pot. Will give in exchange a good collection of correctly-named Lichens from the Scottish Mountains, or a collection of well-mounted and named slides of microscopic fungi for the microscope.—WORTHINGTON G. SMITH, 15, Mildmay Grove, London, N.

Plate I.



H. E Forrest. del.

On the Development of the Vorticellidæ

THE NATURAL HISTORY AND DEVELOPMENT OF THE VORTICELLIDÆ.*

BY H. E. FORREST.

The Vorticellæ are familiar objects to almost everyone who possesses a microscope. Wherever there is water, salt or fresh, the various species are to be met with, differing in minor points, but all bearing a strong and unmistakable family likeness to one another. They are seen to the best advantage with a black background illumination, and when thus shown are perfectly lovely. The light seems to ripple and dance over their delicate milk-white forms, as the cilia lash the water into a hundred eddying whirlpools. With lightning rapidity, first one and then another darts backwards, each tiny stalk coiling up like a python, then slowly but gracefully unwinds till at full stretch, when the ciliary wreath again displays itself. All is done, too, with the most perfect grace; nothing is clumsy or unwieldy in all their various actions, and few, if any, natural objects can vie with them for beauty.

But their charms seem powerless to secure from Naturalists the amount of attention which they deserve, and they are usually passed over with merely a cursory glance, simply because they are common. It is the object of this paper to show that the history of the Vorticellidæ is a deeply interesting, as well as a fascinating study, and by describing what is already known of them to point out what a vast field for original research lies open here for those who have the zeal and patience to penetrate a little more deeply into the subject than they have hitherto done.

In order to render it as clear and concise as possible, my paper will be confined to four species, typical of four genera, and each will be treated of separately. These four species are:—

(1) *Vorticella nebulifera*, [Plate I., Figs. 1 and 2.] Stalk long, contractile, not branched; usually gregarious.

(2) *Carchesium polypinum*, [Plate I., Fig. 3.] Stalk long, contractile, branched, spreading. Bells on one side of branch only.†

DESCRIPTION OF FIGURES.—PLATE I.

1.—*Vorticella nebulifera*, expanded, ×250 diameters. *a* contractile vesicle, *b* disc, *c* rim, *d* vestibule, *e* nucleus.
2.—*Vorticella nebulifera*, contracted, ×250 diameters. *a* rucleus.
3.—*Carchesium polypinum*, ×100 diameters.
4.—*Carchesium polypinum*, stem of, ×250 diameters.
5.—*Carchesium polypinum*, individual, ×250 diameters.
6.—*Epistylis leucoa*, ×100 diameters.
7.—*Epistylis leucoa*, individual, ×250 diameters. The arrows indicate the movements of the contents.
8 and 9.—*Vorticella*, showing self-division, ×200 diameters.
10, 11, and 12.—*Vorticella*, showing encystation, ×350 diameters.
13.—*Vorticella*, showing acinetation, ×250 diameters.
14.—*Vorticella*, free embryo, ×300 diameters.
15.—*Carchesium*, showing gemmation, ×200 diameters.

* Abstract of a paper read before the Birmingham Natural History and Microscopical Society, December 10th, 1878.

† Ehrenberg figures this species with bells on both sides of the branch, but this is incorrect.—H. E. F.

(3) *Epistylis leucoa*, [Plate I., Fig. 6.] Stalk shorter, rigid, not contractile, branching irregularly at the top, so as to form a large head of bells.

(4) *Zoothamnium arbuscula*. Stalk thick, tapering, contractile, and branched horizontally at the top, each branch subdividing in the same plane. Bells of two kinds on both sides of branches.*

(1.) *Vorticella nebulifera*. The name Vorticella, diminutive of the Latin vortex, a whirlpool, was given to the genus in allusion to the currents which they produce in the water, and this species was called nebulifera, cloud bearing, because, from its gregarious habits, it imparts a cloudy appearance to the objects to which it is attached. In its normal condition [Plate I., Fig. 1] the Vorticella is a little bell supported on a long, slender, hollow stalk, which contains a well developed muscle, easily seen with an oblique light. Although no nerves have been detected in connection with it, its powers of sensibility and contractility are very great. When expanded the tube is straight, but the enclosed muscle is always spiral, and when contracted the tube is also thrown into a spiral, [Fig. 2,] and thus shortened. The act of contraction is very sudden, but the re-expansion much slower. During contraction the ciliary wreath is withdrawn into the body. As it slowly uncoils, first the stem straightens, then the centre of the bell rises up, and the edges curl over outwards, and, lastly, the cilia are set in motion. Of course the converse of this takes place when the animal contracts, but then the action is so swift that the eye cannot follow it.

The body consists of (1) an outer layer, the cuticle, marked with fine, dense, parallel striæ [Figs. 1 and 2;] (2) an inner cortical layer, in which are imbedded a contractile vesicle [Fig. 1*a*] and a nucleus, [Fig. 1*e*,] the latter usually invisible unless reagents are employed to show it; and (3) an interior mass of sarcode, containing several globular bodies called food-vacuoles. At the top margin of the bell there is a projecting rim [Fig. 1*c*] surrounding a circular space called the disc, [Fig. 1*b*,] at one end of which is a depression called the vestibule, [Fig. 1*d*,] and at the bottom of this the mouth and anus are situated, the latter, however, only visible when in use. There is a short œsophagus leading from the mouth into the interior. The rim is plentifully supplied with cilia, which, by their constant action on the surrounding water, sweep a succession of minute particles of food into the vestibule, where they accumulate into a kind of pellet. When sufficient is collected the animal gulps it down, together with a small portion of water, and this mouthful floating into the sarcodous interior becomes a food-vacuole.

It is in the processes of multiplication and reproduction that we meet with the most interesting phases of the life-history of the Vorticella. These are four in number, viz., fission, gemmation, encystation, and acinetation. The first of these, fission or self-division, is by far the most frequent, and I have witnessed it many times. When this is about to take place, an adult bell begins to alter its shape, becoming first globular,

* This will be illustrated in a subsequent number.

then flattened at the top. Presently a constriction appears, extending from the top downwards, [Fig. 8,] and this deepens till the bell is cut into two halves, only connected by the stem, which is common to both. The one which is to remain on the old stem now re-opens its ciliary wreath, but on the other, which will ultimately break away, a new wreath is formed *at the end nearest the point of attachment*, [Fig. 9.] The new cilia appear first as loose hairs, moving listlessly to and fro in the water, but these soon lengthen, their strokes increase in vigour and rapidity till the bell trembles as if impatient to be off. It now begins to revolve, slowly at first, then gradually faster and faster, till the slender point of connection snaps, and away shoots the bell, gliding swiftly and merrily through the water. After whirling about for some time, it chooses a place of rest, settles down, and after brooding over it for some time, begins to rise by the growth of a new stalk, which soon attains a considerable length. The cilia have by this time disappeared, and a third set is formed at the top, so that now the animal resembles in every respect the parent from which it sprang.

Gemmation, or budding, is not of nearly so frequent occurrence. I have not seen it myself in Vorticella, though it does occur, but I have seen it in *Carchesium polypinum*, [Fig. 15.] The process is very similar to the last, but the new animal, instead of being formed from one-half of the old one, is produced near its base by the expansion of the cuticle into a kind of protuberance or bud, which is nourished, as in Hydra, by the parent, the body cavities of both being continuous with one another. As in the last case, the bud develops a circle of cilia near its attached end, and breaks away to find a home elsewhere.

The two remaining reproductive processes are inseparably connected with the organ called the "nucleus." This organ is present in all the Infusoria, and is almost universally believed by zoologists to be of a sexual nature, but what are its precise attributes remains at present a mystery. But whatever may be its function, the part it plays in the two following events is very remarkable. In all the Vorticellidæ it is long and band-like, and in the species now under consideration it is curved like the letter C.

The Vorticella at an earlier or later period of its existence withdraws the disc and circle of cilia, and contracting itself into a ball secretes a gelatinous covering or cyst, which gradually solidifies. The body of the animal [Fig. 10] now appears almost homogeneous, but still contains the nucleus unchanged, and the contractile vesicle, which has now lost all power of contraction, and remains permanently expanded. The nucleus next breaks up into a number of oval discs, [Fig. 11,] which move about in the thin, gelatinous mass into which the substance of the parent has become dissolved. The cyst now becomes filled with separate little sacs, which finally break through its walls and eject their gelatinous contents with the included embryos into the water, there to give rise to a new generation of Vorticellæ. I regret that I have never been able to see this mode of propagation, and the only author who really appears to have observed it is Stein, on whose authority I give it. The

same author is also responsible for the following account, which is the most extraordinary of all. The process has never received any name, but it is that which I called acinetation on a former page, and the meaning of the term will be evident from the following description:—It commences, as in the last, by the encystation of the Vorticella, which in this case remains on the old stalk, or develops another. The bell then, by a series of almost imperceptible changes, assumes the forms drawn at Fig. 13, and from its two upper extremities sends out pseudopodia like those of an Actinophrys, and knobbed at the ends. This stage has long been known to microscopists under the name of Acineta. The nucleus, which is distinctly observable, divides into two, and one half becomes converted into an active Vorticella, acquiring an ovate form, a circle of cilia round one end, and a distinct mouth at the other, and inside it we may observe a nucleus and contractile vesicle. When mature it tears its way through the membraneous coat of the Acineta, and so becomes free, [Fig. 14.] The latter, however, immediately closes up, the nucleus divides again, and the process is repeated *ad lib.*

When this extraordinary history was first given to the scientific world by Stein, it was contradicted, and at the present day is so much doubted that Huxley, in his recent work on Biology, when treating of the Vorticella, does not even mention it; but I think that Stein's account is doubted chiefly because it lacks confirmation, and I therefore add just one grain of evidence in favour of its truth. One evening in October last, while examining some Acinetæ from Barnt Green, I saw a small Vorticella burst from the body of one of them and swim away.

In this last series of events we have an example of the phenomenon known as the alternation of generations. The Vorticella, instead of producing another being like itself, gives rise to an independent animal of totally different character, and this in the next generation, instead of giving birth to offspring of the same type, produces a Vorticella like the original.

(2.) *Carchesium polypinum*, [Fig. 3.] The name Carchesium is from the Greek *karchesion*, and signifies a goblet or drinking cup, which is narrower in the middle than at the top or bottom; polypinum, from *polypus*, a polyp, referring no doubt to the appearance of the colony when expanded. It only differs from Vorticella in being branched, all the branches converging downwards to a single stem, [Figs. 3 and 4,] which is spirally waved. Each branch contains a muscle, which is not connected directly with the one in the main stem, but is attached to the inside of the stalk; every bell, too, has a separate muscle. By this arrangement every branch is able to contract without the whole colony doing so, and even a single bell may contract without its fellows being affected. The colony originates from a single individual, by a continuous process of self-division, [Fig. 9;] the new animals, however, instead of breaking away, as in Vorticella, remain permanently on the old stem. I have observed gemmation in this species, but the two other methods of reproduction, viz., encystation and acinetation, I have not yet witnessed.

(3.) *Epistylis leucoa,* [Fig. 6.] This is a magnificent species, perhaps the largest of all the Vorticellidæ. The main stem is slender, branching out at the top into a large cluster of bells. It contains no muscle, and is therefore quite rigid, hence the name, from *epi*, upon, and *stulos*, a pillar. Each bell is nevertheless provided with a short rudimentary muscle, [Fig. 7,] which enables it to give a slight twitch when alarmed. On account of their large size the bells of Epistylis are first-rate objects for showing the protoplasmic movements. The whole contents of the bell may be seen marching slowly up one side and down the other steadily and without intermission—an overwhelming proof of the fallacy of Ehrenberg's theory that the vacuoles are independent stomachs all connected together, and to the mouth by an intestinal canal—for it is obviously impossible that such should be the case, when the whole cell-contents, vacuoles and all, revolve within it.

[TO BE CONTINUED.]

MOSS HABITATS.

BY JAMES E. BAGNALL.

(Concluded from page 39.)

"Pleasant both to eye and mind, is an old garden wall, dark with age, gray with lichen, green with mosses of beautiful hues and fairy elegance of form," and on such habitats a great variety of species of moss will often be found; an old wall is the bryologist's botanic garden, where he may leisurely study his pet plants. A slight shower followed by bright sunshine, such a day as we often get in May, will often give him a pleasurable sight, such as he will long remember, for these alternations of wet and dry call into full play the peculiar properties of the annulus, and if he have only patience to watch and wait, he will see the little lids of many of the capsules thrown off by a sort of magic force; and if the moss he is watching be a Bryum or a Hypnum, the outer fringe will be thrown back like the rays of a beautiful star fish, the inner fringe all the while opening and closing, and the spores shot forth, by some hidden force within, a little cannonade of tiny balls, seeming as though the fairies were practising their minute artillery. Or, if continued dry weather has shrivelled up the mosses, so that they look more dead than alive, a slight shower will at once reanimate the shrivelled tufts, and he will see every moss as it drinks in the grateful fluid, waken again into life, the shrivelled-up leaves once more assume their natural habit, the whole mass looks like a new growth, and the sudden resurrection calls to one's mind that wonderful desert plant *Anastatica*, the Rose of Jericho. But why direct one's attention to walls for watching phenomena that must be common to all moss habitats? Simply because a wall is so convenient, and the whole phenomena may be watched in such places without the fatigue of stooping. Stone walls, mud walls, and walls of every sort and degree, are all worthy of the bryologist's particular attention, and the older the

walls the richer the spoils as a rule. So prolific, however, in mosses are these habitats, that I shall not be able to mention a tithe of what may be found by an industrious worker, and hence shall confine my remarks to a few of the more frequent species, such as *Tortula muralis*, *T. marginata*, *Grimmia apocarpa*, *G. pulvinata*, *Bryum capillare*, *B. cæspiticium*, *B. argenteum*, *Didymodon rubellus*, and *Pottia lanceolata*.

Tortula muralis is one of our most frequent mosses, often filling up the interstices between the bricks of an old wall from its base to its top, growing in hoary, bluish-green tufts; the leaves are oblong with blunt tips, terminated by white hair-like points, very hoary in some of the varieties; the leaf-margin is recurved, leaf-cells minute and opaque in upper part, transparent and elongated below; the capsule is erect; lid shortly beaked; fringe of thirty-two teeth, beautifully twisted.

Tortula marginata is a more local species, partial to damp stone walls, and usually growing on the surface of the stone. At first sight not unlike the foregoing, but has narrower leaves, with the margin *thickened*, not recurved, and terminated by a minute green point. The fruit-stalk, too, is yellow in this species; reddish in *muralis*. Fruit characters similar to the last.

Grimmia apocarpa is a not unfrequent denizen of wall tops, forming deep green loose tufts. The upper leaves are hair-pointed, with recurved margins. The capsules are sessile among the surrounding (perichætial) leaves. Lid slightly beaked; fringe of sixteen teeth, dark red, marked with transverse bars and sometimes perforated.

Grimmia pulvinata is a very common species, growing on walls, and often in great masses on thatched roofs, forming round, hoary, cushion-like masses. The leaves are densely crowded, and suddenly terminate by long white hair points. Fruit-stalk longish and bent downwards, so that the capsule is often hidden among the leaves. The lid has a straight beak; the teeth of the fringe sixteen, deep red and sometimes cloven at the tips. Calyptra mitriform, five lobed at the base.

Bryum capillare is very fond of old walls, and is very frequent; often occurs in large dense dark green masses. The leaves are spreading when moist, but strongly twisted when dry, somewhat oblong and abruptly hair-pointed. Capsule somewhat pear-shaped, and pendulous; lid conical, with a minute point; fringe double; outer fringe reddish-brown, beautifully barred; inner fringe membraneous, paler; spores small, green. The peristome of this common moss is a most beautiful object for the microscopist.

Bryum cæspiticium is also very frequent, growing in close compact tufts, of a yellowish or green colour. Usually very much like the last at first sight; but in this the leaves are erect (not twisted) when dry, the lid yellow, not red as in *capillare*, and the spores minute and yellow.

Bryum argenteum may be readily known by its beautiful silvery foliage. The leaves are closely imbricate, (overlapping;) capsule pendulous, and passing abruptly into the fruit-stalk. Green forms, however, occur; but may at once be known by the closely-imbricated leaves, with large cells.

Didymodon rubellus, so far as my own observations serve, is somewhat local; is usually fond of old shady walls; and fruits from November to February. Grows in dull green tufts, which are reddish below; the leaves lance-shaped, somewhat clasping the stem at their base; margins recurved; leaf-cells minute in upper part, towards the base elongated and transparent. The leaves, too, are spreading when moist, but twisted when dry; the capsule is cylindrical; fringe of sixteen simple teeth; lid slightly curved and beaked.

Pottia lanceolata I have usually found abundantly on the mud-capped walls in the Lias districts of South Warwickshire; growing in rather loose dark green patches, often of great extent. The leaves are variable in size and form, generally oval-oblong, tapering, with longish green points; and slightly keeled on the back. Leaf-cells rather large, quadrate above, longer and transparent below; capsule erect; fringe of sixteen teeth; lid beaked.

A true bryologist should never be afraid of damp and dirty boots; if he be, I am afraid he will scarcely care to follow me to the habitats I have next to mention, that is, the marshes and bogs, and will thereby lose some of the rarest and most beautiful of the mosses. The odours of a marsh are not always of so grateful a nature as one would desire for a bouquet, but the gems which cluster round its margin, or more boldly brave its deeper depths, are worthy to be placed among the fairest of the floral world, and speak as loudly of the marvellous skill of the Great Designer, as the most beautiful and complicate of God's creatures. He who doubts this should examine with the microscope the wonderful structure of a Sphagnum leaf; and if the delicate network that he will then have revealed fail to charm, it will be because his power of appreciating beautiful objects is limited. Among other denizens of these watery situations he will find the Sphagnums most abundant, and such mosses as *Bartramia fontana*, *Mnium subglobosum*, *Hypnum cuspidatum*, *Aulacomnion palustre*, and many other species, which space will not permit me to name.

Many species of *Sphagnum* will be found in these habitats, but the species I find most widely diffused is *Sphagnum cymbifolium*. This often forms extensive masses, of a pale green colour, and may readily be known from the other species by the obtuse leaves, and by the elongated cells which coat both stem and branches, (the utricles,) being lined with spiral threads.

Bartramia fontana is a frequent denizen of our Warwickshire marshes, but rarely in fruit. It occurs in more or less dense tufts of a glaucous green colour, and has the stems much matted together by reddish rootlets; the leaves are mostly ovate, with a prolonged point, have reflexed margins, and are slightly plicate at the base; the cells are small and quadrate; the leaf-margin bluntly toothed; the capsule is roundish, curved, marked with deep longitudinal furrows, and reddish-brown when ripe; fringe double; lid convex.

Mnium subglobosum is a more local moss, but abundant in some marshes, occurring in dark-green tufts. The leaves are large, roundish,

blunt, bordered with one or two series of elongated cells, the principal portion of the leaf being formed of largish, roundish, hexagonal cells; the capsules roundish, with a small, shortly-beaked lid; fringe similar to that of the Bryums.

Aulacomnion palustre is closely allied to the last, is fond of boggy or marshy places, and is usually abundant where it does occur; rarely, however, found in fruit. This species grows in large yellow tufts; the stems are coated by numerous reddish rootlets, and hence are much matted together; the leaves are crowded, spreading when moist, much twisted when dry, somewhat lance-shaped, roughened with minute projections on the surface, and toothed at the tips; leaf-cells roundish; the capsules are very rarely formed, but not unfrequently little green stalks are produced, which bear at their tips minute balls of gemmæ-like bodies, by which the plant is perpetuated.

Hypnum cuspidatum is a very frequent inhabitant of marshes and other damp places, and usually fruits abundantly. This species grows in tall greenish or reddish brown tufts; the stems are often 4in. to 6in. long, pinnately branched ; branches remarkably cusp-like at the tips; leaves large, oblong, rather blunt, and nerveless; leaf-cells narrow and elongated; fruit-stalk lateral; capsule curved and turned to one side; fringe, consisting of an outer row of sixteen beautifully barred teeth, and an inner membrane of sixteen tooth-like processes; lid conical.

The foregoing notes on moss habitats are, I am convinced, full of faults; they have, however, been given in the hope of calling the attention of some of the students of Nature to a vast and very beautiful family of plants, and, if they should induce any one to give some of his spare moments to this study, they will have served the purpose for which they were written.

NOTES ON COLEOPTERA, &c.

BY THE REV. W. W. FOWLER, M.A.

Much has been said about the scarcity of Coleoptera in the Midlands, but though the southern districts of England undoubtedly produce more species, yet the midland districts, if thoroughly worked, are by no means unproductive of good things, and in some genera are very rich.

The fact of the matter is, that while Lepidopterists may be counted by the hundred or the thousand, Coleopterists may almost be numbered by units. It is natural that this should be so, for the butterflies and moths are emphatically "common objects of nature." They are conspicuous objects for the most part, and thrust themselves upon our notice; they are, too, except a few groups, easily made out and easily arranged. Beetles, on the other hand, are obscure in their habits, and in many cases are very hard to name; the number of British species too—more than 3,000—is alarming to the beginner; and yet if one really does begin in

earnest the interest never seems to flag. Work can be carried on at all times and seasons without a long idle time in the winter, which falls to the lot of Lepidopterists; a very little work and perseverance will suffice to give a knowledge of the chief genera, and when this knowledge has been acquired, and the student begins to make out his own specimens, when the first drudgery has been passed through, he will not be likely to give up his study, but will find it ever growing upon him, and opening out new fields of interest.

The scarcity of workers at present has of course the effect of limiting the discoveries made, but I need only mention three beetles, all discovered in the midland district by one indefatigable worker—Mr. J. T. Harris, of Burton-on-Trent—to show that the fields are well worth the labour. *Macronychus 4-tuberculatus*, (new to Britain,) taken in the Dove, near Burton-on-Trent; *Bagous diglyptus*, (recorded in the *Entomologist's Monthly Magazine*, for March, 1879, as new to Britain and rare even on the Continent,) taken near Burton-on-Trent; and *Cryptocephalus 10-punctatus*, taken in Staffordshire a year after its first discovery at Rannoch by Dr. Sharp.

I would strongly advise any one who takes up the Coleoptera to join with it the study of the Hemiptera or bugs. They are found for the most part under the same conditions, and in the same places as the beetles, and are very easily mounted and preserved. Still more remains to be done in this group than among the Coleoptera, and any one working them thoroughly will be very likely to discover new species.

By ordinary persons beetles and bugs are resolved into one species apiece—the black-beetle or cockroach, and the *Cimex lectularius*, to give it its polite name. But it will not take much study to find out that the former insect belongs to the Orthoptera, (grasshopper and cricket tribe,) and not to the Coleoptera, and is, therefore, not a beetle at all, and that the latter is an obscure member of a most beautiful and varied group of insects, whose usual habitat is widely different from that of the obnoxious insect referred to.

Believing that many more people would take up this study if they knew how to set about it, I venture to offer a few hints as to apparatus, mode of preservation and setting, localities, &c., and shall hope in a future paper to say more about beetles generally.

1.—Apparatus.—This is very simple. An old umbrella and a good stick for beating, a brass Y to carry a round of cane for sweeping and water nets (the former to be made of unbleached calico and the latter of coarse cheese cloth) will be all required for summer work; while a fern-trowel, a sheet of brown paper, and, if possible, a sieve will be ample for winter. The bottle for holding the captures should have a wide cork, through which a quill or glass tube should be inserted, corked at the top, and through this tube all the beetles caught should be bottled, as some will be sure to escape if the large cork be frequently removed. A separate bottle should be carried for the larger beetles, as they are sure to injure the smaller ones if placed with them.

2.—Modes of Killing, Preservation, and Setting.—The most merciful way of killing all invertebrate animals is by boiling water, and, if it is wished to set the beetles caught at once, it must be the method adopted; for very delicately formed Coleoptera and Hemiptera it is by far the best plan in any case; but laurel is the great agent. A few words may be spent on this subject with advantage, as the proper use of laurel seems very seldom understood. Only the young shoots and leaves must be used, and these must be gathered on a dry sunny day, as if gathered wet the beetles will soon turn mouldy. The laurel must be chopped very fine and kept tightly corked. Beetles killed in laurel cannot be set at once, but must be kept for three or four days or more in the laurel until the collector finds that they are thoroughly relaxed. If a jar of good dry chopped laurel be kept, and after each day's work the beetles obtained be removed from the bottles and placed in muslin bags, and laid in the jar, they will keep for any length of time. They must, however, be given air every now and then, and the laurel examined for mould; with a little care, however, in this way, they will be quite fit to set a year or môre after their capture. For setting, two camel's hair brushes—one blunt, the other with a hard fine point—a pin with a bent point, some gum tragacanth, and some card with a slightly rough surface are required. When the beetle wished to be mounted is thoroughly relaxed lay it on its back, brush out its legs and antennæ with the blunt brush, put a little gum on the card, take up the beetle with the hard brush, lay it on the card, brush the legs and antennæ into their natural positions, cut the beetle out, and insert a pin through the card behind it, not however too near the body; raise the card half-an-inch up the pin, and the specimen, after a thorough drying, will be fit for the box or cabinet. The larger species must not be carded, but pinned through the right elytron, and *not* through the thorax.

The third point, that of localities, would here take up too much space, so I will continue the subject in another paper.

I would, however, mention that the best books for all students of Coleoptera and Hemiptera are the following:—"Rye's British Beetles," which may be obtained for 7s. 6d., from Mr. Joel Rowsell, 9, King William Street, Strand, London, a very useful book for beginners; "Cox's Handbook of Coleoptera," 2 vols., 17s. 6d.; "Saunders' Synopsis of the British Hemiptera," price 5s. The two last may be obtained from Mr. E. W. Janson, 35, Little Russell Street, Bloomsbury, London.

RARE ORNITHOLOGICAL OCCURRENCES IN SOUTH LEICESTERSHIRE.

BY THOMAS MACAULAY, M.R.C.S.L., KIBWORTH.

I send the following ornithological notes in the hope that they may act as a stimulus to others to make observations in this most interesting subject, and report upon them in the "Midland Naturalist."

The district over which these observations extend is a very limited one, and moreover is little calculated to yield fruitful results by reason

of its character—almost entirely destitute of woodland and water, it presents but few opportunities for collecting notes, or for observing the migration of rare birds—yet with all its drawbacks I have succeeded in obtaining sufficient observations to justify me in the hope that they may at least prove interesting.

Many of the facts recorded below are due to the observations of my friend, the Rev. A. Matthews, Gumley Rectory, whose name alone in the world of Natural History is a sufficient guarantee for their accuracy.

The observations extend over the last twenty-five years, and the most rare birds are given as nearly as possible in the order of date, and a list is added of others not so uncommon.

Rose-coloured Pastor, *(Pastor roseus,)* seen amongst a flock of starlings, near Foxton, no date.

Raven, *(Corvus corax,)* once seen near Gumley, no date.

Great Snipe, *(Scolopax major,)* shot near Lutterworth.

Snow Bunting,*(Plectrophanes nivalis,)* one shot at Laughton, no date.

Pied Flycatcher, *(Muscicapa atricapilla,)* seen at Kibworth, 1859.

Gray Phalarope, *(Phalaropus lobatus,)* shot near Foxton, 1860.

Temminck's Stint, *(Tringa Temminckii,)* shot at Saddington Reservoir, 1860.

Stormy Petrel, *(Thalassidroma pelagica,)* found dead near Gumley, 1862.

Goosander, *(Mergus castor,)* a female, shot near Smeeton, 1862. This bird was also seen in 1866 and 1877.

Golden Eagle, *(Aquila chrysaëtos,)* seen flying W. by Rev. A. Matthews, 1863.

Black Tern, *(Sterna fissipes,)* shot at Saddington Reservoir, 1865.

Manx Petrel, *(Puffinus Anglorum,)* picked up exhausted near Gumley, 1867.

Sand Grouse, *(Syrrhaptes paradoxus,)* five seen near Laughton, 1867.

Garganey, *(Anas circia,)* four shot at Saddington Reservoir, 1868.

Great Northern Diver, *(Colymbus glacialis,)* seen on Saddington Reservoir, where it remained for a fortnight, 1872.

Black-throated Diver, *(Colymbus arcticus,)* shot on Saddington Reservoir, 1874.

Red-necked Grebe, *(Podiceps rubricollis,)* shot on Saddington Reservoir, 1874.

Scaup Duck, *(Fuligula marila,)* shot on Saddington Reservoir, 1874. This bird is not an unfrequent visitor.

Peregrine Falcon, *(Falco peregrinus,)* a pair seen near Saddington, 1877.

Small Spotted Woodpecker, *(Picus minor,)* a pair nested at Gumley, and hatched off on 26th May, 1878. Unfortunately their nest was discovered by a boy, who captured and killed the old one and destroyed the young.

I now pass on to the less rare birds which appear deserving of notice:—

Great Black-backed Gull, *(Larus marinus,)* has been seen occasionally.

Herring Gull, *(Larus argentatus,)* has been seen occasionally.

Common Gull, *(Larus canus,)* often seen.

Kittiwake, *(Larus tridactylus,)* often seen.

Curlew, *(Numenius arquata,)* often seen.

Whimbrel, *(Numenius phæopus,)* often seen.

Green Sandpiper, *(Totanus ochropus,)* a constant winter visitor.

Common Sandpiper, *(Totanus hypoleucos,)* a constant summer visitor.

Merlin, *(Falco æsalon,)* often seen in winter.

Ring Ousel, *(Turdus torquatus,)* occasionally seen, one shot at Gumley a few years ago.

Spotted Rail, *(Crex porzana,)* has been frequently shot, one this year.

Pochard, (*Fuligula ferina,*) occasionally seen and killed.
Golden Eye, (*Fuligula clangula,*) occasionally seen and shot.
Quail, (*Coturnix communis,*) often seen.
Wild Goose, probably the Bean Goose, (*Anser segetum,*) occasionally seen, but no specimen has been obtained so as to verify the species.

I will also add, though not belonging to Leicestershire, the appearance of five Avocets, (*Recurvirostra avocetta,*) from the note book of my friend Mr. Matthews. They were seen on the Trent, near Newark, in 1860.

CRYSTALLISATION OF WATER.

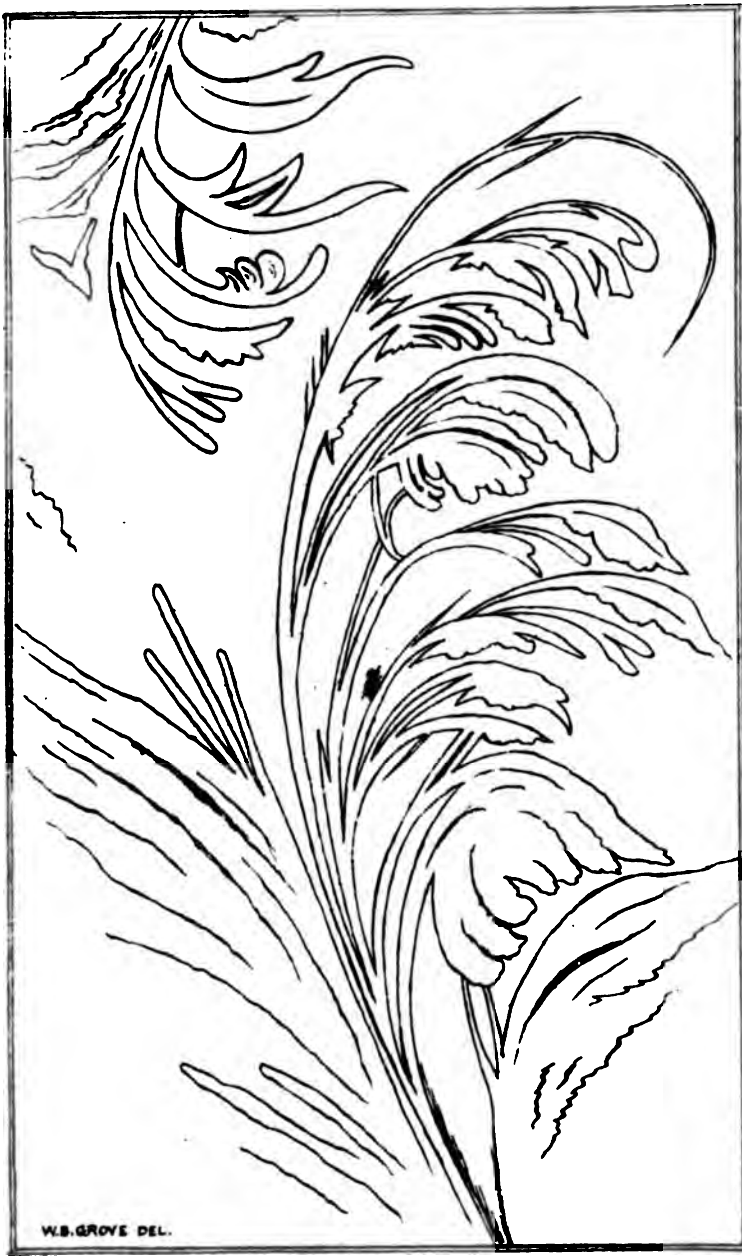
By W. B. Grove, B.A.

The frontispiece of Professor Tyndall's "Light" is an engraving from a photograph of what he calls "a surprising case of crystallisation." The following is the account given of it by Professor S. H. Lockett, of Louisiana State University. "In my drawing room I kept a wash-basin in which to rinse out the colour from my water-colour brushes. This colour gradually formed a uniform sediment of an indefinite tint over the bottom of the basin. On the night of the 26th of December last, (1873,) which was an unusually cold one for this climate, the water in the basin froze. On the melting of the ice the next day, the beautiful figure you see on the photographs was left in the sediment. I carefully poured the water from the basin, let the sediment dry, and thus perfectly preserved the figure."

During the severe weather of last December a quantity of rain-water was left in a jug in my room, and the impurities of the water were deposited in a grayish sediment on the bottom. One night the water froze, not only at the top, but also round the sides and bottom where it was in contact with the jug. The ice-crystals on the curved bottom, as they grew, removed the thin layer of sediment from the smooth surface. Consequently, when the ice was melted and the water poured out, a beautiful design was seen, in white on a black ground, consisting chiefly of gracefully-curved slender plumes. I made a sketch [Plate III.] of one of the most exquisite of these; it is slightly enlarged, but is otherwise as faithful a copy as I could produce. It is remarkable how similar it is in many points to one of the plumes in Professor Tyndall's engraving. The repetition of the same general plan in the details of successive parts is especially a feature in which the two agree, as also the backward prolongation of many of the spicules.

The great interest of these forms lies in the beautiful curves of which they consist. With the idea of a *crystal* we usually associate that of straight lines and plane surfaces, and, although instances to the contrary are not uncommon, it is but seldom we meet with curves so graceful as those here depicted. They arise from the varying play of the molecular forces combined with the adhesion between the molecules and the surface on which they are deposited. They form one of the links connecting the forms of inorganic with those of organic nature, and recall to us Professor Tyndall's words:—"Who is the builder in the case of a crystal (of the plumes in our frontispiece, for example?) Either a detached architect does the business, or these wonderful structures are self-erected, in virtue of their inherent forces. In building a crystal nature makes her first real effort as an architect. Here we have the first gropings of the so-called vital force; but the most wonderful manifestations of this force, though depending upon processes of higher complexity, are, I hold, of the same quality as those concerned in the growth of a crystal."

Plate III.



Crystallisation of Water—Ice Plumes.

Microscopy.

Insects Mounted without Pressure.—The mounting of whole insect preparations, or special organs, for examination under the microscope has always been a favourite pursuit with amateurs. The usual method is so well known as to need no description; probably no microscopist is without specimens prepared by himself, by friends, or by professional mounters. But how few of the objects are really of value to the biological student? As usually prepared the "insect preparations" are merely flattened-out and feeble reminiscences of what they were when alive; their more minute organs are frequently obscured, or if any attempt at arrangement has been made so as to display the noticeable parts of their structures, the conditions of the "squashed" mounting almost invariably prevent anything like naturalness in the appearance of the object. Mr. Frederic Enock, of 30, Russell Road, Seven Sisters Road, London, a well-known entomologist, has recently presented to the Birmingham Natural History and Microscopical Society a number of preparations of insects of a very different kind from those we have referred to. Some of them are mounted in deep cells without pressure, and in these more particularly the characteristic features of the living insect are wonderfully preserved. Not only is the exterior aspect of the insect presented unimpaired, but very much of its internal structure also can be clearly made out when suitably illuminated. The following is a brief description of the exceedingly beautiful slides presented to the Birmingham Natural History and Microscopical Society:—

1.—Head of Sand Wasp, *(Cerceris arenaria,)* mounted in fluid for examination by paraboloid or as an opaque object. In this preparation all the parts of the head and mouth of the insect are skilfully and beautifully displayed, and an observer could profitably spend some hours in its study. Amongst other interesting organs to be easily made out are the two kinds of eyes, "compound" and "simple," the semi-club-like antennæ, the powerful jaws, with their fringe of fine hairs, and the wonderful labium, with its tiny palpi and delicate ciliated ligula.

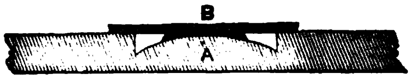
2.—Lace-wing Fly, *(Chrysopa perla,)* mounted in balsam. Every part of this interesting insect is well shown, especially the strongly-spined wing-rays.

3 and 4.—The Common Gnat, (male and female,) *(Culex pipiens,)* exquisitely mounted so as to be attractive to the ordinary observer, and useful to the student of insect anatomy.

5 and 6.—Garden Spider, *(Epeira diadema,)* (male and female.) The mouth parts, spinnerets, and other important organs all well arranged for examination by any powers.

Mr. Bolton sends us the following list of living microscopic objects sent out by him during the last nine weeks to his subscribers:—"Specimens of embryo trout and salmon, *Œcistes crystallinus*, *Rhynops vitrea*, *Hydatina senta*, *Euglena viridis*, *Spirostomum ambiguum*, *Spongilla fluviatilis*, and *Plumatella repens*, just emerging from the statoblast or winter egg. With most of these I have sent drawings from life by Mr. H. E. Forrest, or copies of published illustrations. I have now coming forward *Cristatella mucedo*, the curious locomotive polyzoan, the colonies of which creep about aquatic plants.—Thos. Bolton, 17, Ann Street, Birmingham."

THE WEBER SLIDE is a simple but useful contrivance which students of fresh-water life will find a most helpful addition to their appliances. "The ordinary concave slide, though better than a plain slip of glass, does not fulfil all the requirements of the microscopist, and with such a slide it is difficult to keep the object in focus except with very low powers. To obviate these difficulties Mr. Weber has reversed the form of the cell, and forms his slide as shown in the accompanying woodcut,



where A is the convex bottom of the cell, and B the thin glass cover, a drop of water being held between them by capillary attraction. When the cover is cemented down by means of a little waterproof cement the water cannot evaporate, and the whole arrangement forms an air-tight aquarium on a minute scale. The open space forms a chamber which retains a supply of air, and if the animal and vegetable life are properly balanced life may exist in one of these slides for weeks. In the woodcut the thickness of the slide &c., is magnified about four times." This description is taken from the "Journal of the Royal Microscopical Society," Vol. II., p. 56, to the Editor of which we are indebted for the loan of the illustration.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF FEBRUARY, 1879.

BY W. JEROME HARRISON, F.G.S.

February proved a cold and wet month, fully maintaining the severe character of the winter of 1878-9. Rainfall was above the average, but was, perhaps, not so remarkable for its amount as for its persistency, there being only some five days on which no rain was measured. Snow fell on ten or twelve days, to the depth of from three to six inches on the 1st and 24th. Opening with some days of frost, a thaw set in on the 6th which continued to the 16th. A thaw also marked the last day of the month. The sky was mostly overcast, and there were several foggy days. The barometer ruled low, with variable winds. At Oxford lightning was seen on the 17th, a solar halo on the 20th, and lunar halo on the 7th. The absence of small birds was noticeable; at Orleton "very few blackbirds, and no thrushes, fieldfares, or redwings have been seen;" at Shifnal "all the starlings (of which we had flocks) deserted us, a few only returning at the end of this month; the same with regard to throstles. Blackbirds remained, and were saved, with robins, chaffinches, tits, and hedge-fauvets, by coming to be fed with the sparrows;" at Coundon "no fieldfares or redwings seen in this neighbourhood since December 10th, when three were picked up dead or dying in this garden." Vegetation was very backward. At Burton-on-Trent, hazel and willow flowered on the 22nd. At Coston Rectory the aconite flowered about the middle of the month. At Stroud, "only three plants in blossom, viz., the butter-bur, hazel, and daisy."

STATION.	OBSERVER.	RAINFALL. Total for M. In.	Greatest fall in 24 hours. In.	Date.	No. of rainy d.	TEMPERATURE. Greatest ht. Deg	Date.	Great'st cold. Deg	Date.
GLOUCESTERSHIRE.									
Cainscross, Stroud	W. B. Baker, Esq.	4·11	·74	8	18	54·0	9	20·0	23
Cheltenham	R. Tyrer, Esq.	2·70	·38	13	23	54·8	9	12·4	25
Stroud	T. J. Coley, Esq	3·88	·70	9	22	56·0	10	19·0	23
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	2·26	·35	8	17	50·0	9	21·0	20
Woolstaston	Rev. E. D. Carr	2·83	·47	15	22	52·0	27	20·0	25
Leaton Vicarage, Shrewsbury	Rev. E. V. Pigott	2·76	1·15	8	20	54·2	27	21·0	25
More Rectory, Bishop's Castle	Rev. A. Male	3·22	·47	1	23	52·0	9 & 11	22·0	23, 24,25
Bishop's Castle	E. Griffiths, Esq.	2·85	·31	15	20	53·0	9	21·0	25
Cardington	Rev. Wm. Elliott	2·24	·22	1	17				
Adderley Rectory	Rev. A. Corbet	3·14	·45	8 & 17	19				
Stokesay	Rev. J. D. La Touche	2·51	·47	8	16	54·4	27	22·5	25
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	4·05	·52	8	24			14·0	23
Stoke Bliss	Rev. G. E. Alexander	3·24	·36	15	21	54·0	9	20·0	24
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq	3·35	·45	8	22	54·8	9	15·0	25
West Malvern	A. H. Hartland, Esq.	3·14	·41	13	22	50·0	9	21·5	24
Pedmore	E. B. Marten, Esq.	2·99	·41	8	21	54·0	9	22·0	24
Longlands, Stourbridge	J. Jeffries Esq.	3·01	·40	8	19	54·0	9	14·0	24
Dennis, Stourbridge	Mr. C. Webb	3·03	s)·40	19	21	52·0	9	14·5	24
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	2·54	·43	1	21				
Amblecote	Mr. J. Robins	2·57	·40	8	21				
Dudley	Mr. J. Fisher	2·50	·33	8 & 19	21	54·0	9	22·0	24
Sedgley	Mr. C. Beale	2·49	s)·45	19	19	50·0	9	24·0	24
Kinver	Rev. W. H. Bolton	2·63	·42	8	19	51·0	9	18·0	24
Walsall	Mr. N. E. Best	2·80	·34	1 & 8	19	50·0	9	26·0	1
Grammar School, Burton	C. U. Tripp, Esq.	2·55	·53	17	21	54·0	9	21·0	24
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	2·50	·39	8	23	53·0	9	20·0	25
Wrottesley	E. Simpson, Esq.	2·40	·47	8	19	52·6	10	19·8	25
Heath House, Cheadle	J. C. Philips, Esq.	4·09	·72	8	20	58·0	9	22·0	24
Alstonfield Vicarage	Rev. W. H. Purchas	4·75	·82	13	18	49·5	9	12·0	23
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	3·33	·51	8	22	51·0	9	20·0	24
Coventry	J. Gulson, Esq.	3·25	·51	8	20	53·0	10	21·5	24
Bickenhill Vicarage	J. Ward, Esq.	3·08	·48	8	18	46·0		19·0	
Oscott College	Rev. S. J. Whitty	2·64	·37	1	22	54·0	9	20·9	25
Henley-in-Arden	T. H. G. Newton, Esq.	3·24	·40	8 & 13	21	53·0	9	20·0	25
Rugby School	Rev T. N. Hutchinson	2·88	·45	8	22	53·8	9	23·0	23 & 24
DERBYSHIRE.									
Buxton	E. J. Sykes, Esq.	4·72	·73	7	20	66·1	9	10·9	23
Stoney Middleton	Rev. U. Smith	2·97	·51	8	14	50·0	9	11·0	13 & 22
Brampton St. Thomas	Rev. J. M. Mello	4·18	·70	7	19	52·0	9	16·0	24
Fernslope, Belper	J. G. Jackson, Esq.	3·69	·64	8	22	52·0	9	23·0	24
Linacre Reservoir	C. E. Jones, Esq.	3·78	·69	8	17				
Willersley Gardens	J. Tissington, Esq	4·14	·78	14	11				
Spondon	J. T. Barber, Esq.	2·72	·56	8	21	52·8	9	21·2	24
Duffield	Wm. Bland, Esq.	3·07	·40	4	23				
Trent College	Rev. T. F. Fenn, B.A.	2·88	·60	2	17	55·0	9	18·0	23
NOTTINGHAMSHIRE.									
Tuxford	J. N. Dufty, Esq.	2·44				51·0	9	24·0	2,3,23,24
Hodsock Priory, Worksop	H. Mellish, Esq.	2·76	·49	8	20	60·2	8	17·7	24
Park Hill, Nottingham	H. F. Johnson, Esq.	3·03	·67	8	17	52·5	9	25·0	23
Hesley Hall	B. J. Whitaker, Esq.	2·48	·41	9	19	55·0	10	22·0	24
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	2·45	·43	8	19	55·4	9	18·7	24
Ashby Magna	Rev. E. Willes	2·70	·33	18	20	54·0	9	18·0	25
Market Harborough	S. W. Cox, Esq.	2·84	·35	8	17	52·0	9	21·0	24
Kibworth	T. Macaulay, Esq.	2·50	·47	8	18				
Town Museum, Leicester	W. J. Harrison, Esq.	1·96	·30	9	22	54·8	9	23·6	24
Belmont Villas, Leicester	H. Billson, Esq.	2·09	·45	24	18	55·0	9	24·2	24
Syston	J. Hames, jun., Esq.	2·71	·50	25	19	51·0	10	23·0	24
Waltham-le-Wold	E. Ball, Esq.	2·49	·41	8	19	52·0	9	22·0	23
Little Dalby Hall	G. Jones, Esq.	2·17	·35	13	18	52·0	9	20·0	23
Foxton Locks	Union Canal Company	2·26	·35	8	17				
Coston Rectory, Melton	Rev. A. M. Rendell	1·87	·34	8	22	55·5	9	18·5	23
Belvoir Castle	W. Ingram, Esq.	2·22	·42	9	20	55·0	10	16·0	24
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	2·98	·38	28	19				
Castle Ashby	R. G. Scriven, Esq.	3·21	·44	10	22	53·0	9	20·0	23
Kettering	J. Wallis, Esq.	2·74	·24	8 & 15	20	54·0	10	21·0	24
Althorpe	G. S. Groom, Esq.	2·57	·37	8	20	53·0	9	18·0	23
Pitsford	C. A. Markham, Esq.	2·62	·44	7	18				
RUTLAND.									
West Deyne, Uppingham	Rev. G. H. Mullins	2·16	·52	15	19	54·0	9	19·0	24
Radcliffe Observatory, Oxford	Mr. H. E. Bellamy	3·31	·39	8	22	53·7	9	23·8	23
Spital Cemetery, Carlisle	T. Bell, Esq.	1·20	·26	9	14	47·8	7	18·0	24
Ventnor Hospital	H. Sagar, Esq.	3·86	·68	9	24	60·3	8	26·1	24
Altarnun Vicarage	Rev. G. Tripp	9·02	1·06	11	23	53·0	15	18·0	25

Correspondence.

MIDLAND ENTOMOLOGY.—I am pleased to find that the subject of "Midland Entomology" is being ventilated in the pages of the "Midland Naturalist." It is now many years since Mr. F. Plant and myself worked this county for Coleoptera. My own reason for abandoning the local for a wider field was the persistent impediments placed in the way of our working all the best hunting grounds, the rich and extensive woodlands owned by the present Earl of Stamford. Previous to my own and Mr. Plant's career, the county had been assiduously worked by my brother, (H. W. Bates,) and in happier times, before the decease of the late earl, when free access to all the best localities was unimpeded. The collections then formed are now all scattered. The neat and handsome little collection of Mr. Plant was offered at a cheap rate to our Museum, but was not taken; the committee I suppose not being able to discern any value in "beetles," even although they were a part of our *local fauna*, the obtaining of which *ought* to be one of the prime considerations in the formation and management of a *local museum*. [This was five-and-twenty years ago. They would know better now.—EDS. M. N.] Fortunately, before this dissemination of our local collections took place, a catalogue of all the known Leicestershire species of Coleoptera was compiled by myself for publication in Mr. Potter's "History of Leicestershire." From some unexplained cause this history never came to anything, there not being, I believe, sufficient subscribers obtained to defray the mere cost of its production. A reference to that catalogue, incomplete as it is, will show that our county is quite up to the average in the production of rare, curious, and interesting species. [By the kindness of Mr. Bates the MSS. of this catalogue has been placed for reference in the Library of the Leicester Museum.—EDS. M. N.] The occurrence of a local variety of the grandest of all British beetles, the *Calosoma inquisitor*, is of itself sufficient to tempt investigators to court instead of "to shun as they would the plague" our local hunting grounds. *Tropideres sepicola* and *Trachodes hispidus* also occur to me, the former being new to the British fauna at the time of its capture; and the latter amounting to a re-discovery. I am glad to find amongst us a Coleopterist of the evident calibre of Mr. Robson, whose acquaintance I shall be happy to make.—FREDK. BATES, Leicester.

DOUBLE-HEADED SALMON.—Among some embryo salmon I have lately watched hatching from the spawn, several have shown abnormal development, and I have just found one with two heads, attached together by the neck, so that it has four eyes, but only two sets of gills, and one heart. In fact all the posterior parts are of the usual normal form of a single fish.—THOS. BOLTON.

AQUARIA.—My experience is that H. M. need not trouble himself as to what he shall feed his fish with in the winter season, for they do not need feeding during the cold weather. Roach, Dace, and Minnows thrive the best with me. Perch soon die. In the summer small red worms thrown in are soon disposed of, and either in summer or on mild days in winter, when the fish are extra active, bread pressed between the finger and thumb and dropped in after making into very small pellets is readily taken. A piece of raw meat suspended by a string from a little bit of wood will afford amusement, and should H. M. be blessed with bloodthirsty beetles he will probably find that it will be a source of great satisfaction to them.—C. L.

THISTLES.—Two years ago a fox covert near here (Ravenstone) was cleared of its underwood, to allow fresh to grow up, and the greater part of

the timber was felled. The next year enormous quantities of the common Buck thistle made an appearance, growing to six feet high and so thickly together as to be nearly impenetrable. This is the species of thistle so obnoxious to farmers. I never remember seeing one in the wood before, although they were of not uncommon occurrence in the adjoining fields. What could have been the cause of their sudden appearance?—L. F.

ORNITHOLOGY.—The break-up of the frost revealed the evidence of a sad mortality amongst the poor birds. Great numbers were picked up dead, especially beneath ivy and hedge bottoms, where they had sought shelter. Mr. Arthur Startin writes me that the few days of intense frost ending on Christmas Day were very fatal. Mr. Startin says: "Since the heavy fall of snow the birds have been able to pick up a little food in the hedge bottoms, as I have noticed that the dead leaves under my fences have been carefully scratched over; during those few severe days land unprotected by snow was hard and impervious everywhere. The Starlings, being insect feeders, have especially suffered here. I picked up myself during those days no less than six of these birds which had fallen dead from the ivy on my house. My workmen found several more, and also Robins. The breast bones of the poor things too plainly showed the cause of death. I had hoped that feeding with the sheep and poultry, and also on crumbs, &c., from the house, the birds would have been safe, but when I found the true state of the case, too late, I at once gave them a little animal food also, and the Rooks discovering this became so confident as to come quite close to the kitchen door. I managed to save the life of one poor robin—which I found nearly dead—by placing it in the greenhouse, where it revived and took food, and afterwards, although allowed to go out whenever the ventilator was open, it always returned, and has now become so tame that it will frequently perch upon my finger and take food from my hand. It has even sat upon my beard and picked bread from my lips. It is a male bird, and now makes the house ring with its song."—JOHN GULSON, Coventry, March 5th.

ORNITHOLOGICAL NOTES FROM DERBY.—On January 11th a friend of mine, who knows the bird perfectly well, saw a Waxwing at Chellaston, near here. It was pecking out of a wagon on the railway, but he could not see what it was eating.—All winter, up to March 3rd, I had seen very few Chaffinches about my garden, but on that day I saw and heard a great many, all cocks so far as I could observe. Nearly every tree and hedge had its "Pied Finch," as they call them about here, singing away with all its might, as if to welcome returning spring.—On the night of March 7th, at half-past eleven, I was much surprised to hear a Thrush singing, in a small plantation at a short distance from the house; I listened to him for about twenty minutes, and during the whole of that time he was singing as loudly and clearly as if it were daytime, perhaps rather more in snatches than is usual, but not so much as a Missel Thrush. It was a bright moonlight night, with a slight mist, and rather cold, in fact the next morning the ground was white with frost, though it had been a beautiful day. I have occasionally heard thrushes singing on the warm light nights of early summer, but never before so early in the year, and I think the circumstance is worthy of record.—MERLIN, Derby, March 16th.

ORNITHOLOGICAL NOTES.—I lately procured a female Great Spotted Woodpecker, which was killed near here last spring; it is a very rare bird now in this district, and not common anywhere in England. A pure white Swallow was shot here about Michaelmas; it had been seen for some months. Several peculiar Blackbirds have come under my notice lately:—(1) a cream coloured one, shot in the summer; (2) one with white on the sides of the head, picked up dead early in January; (3) a very beautiful specimen with several of the quills in the wings and tail pure

white, it had been seen about for some time, and presented a curious appearance when flying; it was shot in October, and I had it preserved; all three were cocks. On December 6th I was shown a Tufted Duck and a Razorbill, which had been received here that morning by a bird stuffer, while they were yet warm; they were probably killed on one of the canal reservoirs. This is the first time I have heard of the latter bird being obtained in this neighbourhood. During December I saw several Water Rails and killed two of them; they are seldom seen except in very hard weather. On the 7th of that month I observed some Wild Geese flying over but could not make out the species, and on the 14th February two were seen on some floods; several more were observed at different times, but I did not hear of any being shot. Greylags are sometimes seen here on the stubbles, and Brents and Canada Geese have also occurred. Snipe have been very plentiful this season, and Bramblings more so than I ever remember. I killed a large specimen of the former early in December; it weighed a trifle over five ounces, the average weight being about 3½. I heard Larks and Yellow Ammers singing for the first time this year on the 8th and 10th of February respectively. Wild fowl were still plentiful with us at the beginning of this month. On the 1st I saw hundreds of Wigeon and Wild Duck, also a few Teal and Snipe. They were still here on the 8th, but in less numbers. Rooks began building on the 5th inst., in one rookery; they are a little late this year owing, I suppose, to their sufferings during the winter. On the 6th I noticed our first summer migrant, the Wryneck; I also saw a pair of Stock Doves investigating a hollow tree where they generally breed. — O. V. A., Bodicote, Oxon., March 11th.

Brown Owls.—The following occurrence may be of interest to some readers. At the commencement of the late winter the natives of a certain village near Ashby-de-la-Zouch were alarmed by hearing what sounded to them unearthly cries, disturbing the silence of the night, and sallied out with lanterns to investigate the cause. The noises suddenly ceased, and the village resumed its quiet, but a month afterwards a fine specimen of a brown owl *(Strix stridula)* was unearthed from the sooty recesses of a chimney. It was a fine bird, measuring 35in. across the wings, and it appears that when it had entered the chimney it had been unable to escape. The screech of the white owl *(Strix flammea)* is a familiar sound about here, but the noise which caused the alarm was a decided hoot. Some writers aver that both brown and white owls hoot, others that only the white does, but I think this is an instance in favour of the latter assertion.—L. F.

Abnormal Hen's Eggs.—About ten years ago, a very large Dorking hen's egg was given my father by the keeper of Allington Lock, about 1¾ miles from here. It was larger even than a turkey's egg. On accidentally dropping it, I was astonished to discover that it contained two yolks and another perfect egg, of the usual size, with a shell of the average thickness. It is now preserved in Maidstone Museum, with the outer shell partly removed, so as to show the smaller egg inside. There are, I believe, similar instances on record of one egg inside another. Small fowls' eggs, too, are not unusual. I have two in my collection not larger than magpie's eggs, and another though of the usual length is not larger round than a blackbird's, and terminates in almost a sharp point, a most singular looking thing. These are not the results of domestication, for I have a jackdaw's egg not so large as a thrush's.—Fred F. Grensted, Maidstone.

[A double hen's egg is reported in "Science Gossip" for 1868, p. 117. In same Vol., at p. 151, is an interesting article on monstrosities in eggs in general, in which the writer says, speaking of the extremes of size in hens' eggs, that he has one little above the size of that of a wren's, and another 4½oz. in weight.—Eds. M. N.]

Gleanings.

THE MIDLAND UNION.—We have pleasure in stating that the Nottingham High School Natural History Society has joined the Union.

PRE-CAMBRIAN ROCKS.—The sum of £50 from the Government Fund for the Endowment of Scientific Research has been granted, on the recommendation of the Royal Society, to Dr. C. Callaway, M.A., F.G.S., of Wellington, Salop, in aid of his researches into the relations of the pre-Cambrian rocks.

AMERICAN QUARTERLY MICROSCOPICAL JOURNAL.—We have received Nos. 1 and 2 of this excellent periodical, which publishes the transactions of the New York Microscopical Society. The articles are varied, many of them being of great value; the illustrations are truly excellent, and the paper and printing as good as can be desired. All the societies in our Midland Union interested in microscopy should subscribe for this journal. It is published by Messrs. Hitchcock and Wall, 150, Nassau Street, New York, and the subscription, post free, is 13s. 6d. per annum.

FREDERICK SMITH, F.L.S., Assistant-keeper of the Zoological Department of the British Museum, died on the 16th February last, aged 73. He was not better known than appreciated by every entomologist engaged in the study of the British Hymenoptera. His loss will be most deeply felt, and a wide gap has been made in the ranks of true entomologists which it will be almost impossible to fill up. All who have been in the habit of submitting their captures of Bees and Wasps to Mr. Smith for identification will feel their loss more and more as their collections increase, for his valuable services in the arduous work of naming specimens were always most willingly rendered, and he did in a few hours what to most others would have been an endless if not impossible task. His work on the British Apidæ is full of original observations. All who attended the late Entomological Exhibition at the Royal Aquarium will remember how willingly he worked to ensure a successful meeting, and how he lent his magnificent and unique collection of British Bees and Wasps, "the work of forty years' patient collecting and study." Though we shall never meet him again, either in our rambles at Hampstead Heath, or in his place at the Museum, (where he had been twenty-seven years,) his name and works, and his prompt willingness to help the young entomologist will never be forgotten by "one who loves to hear the music of the Wild Bee."—F.E.

THICKNESS OF THE ANTARCTIC ICE.—Dr. Croll has sent us a reprint of his paper on this subject, which appeared in the "Journal of Science" for January last. The Southern Pole is enveloped by an ice-cap, which reaches to lat. 70°, and has an average diameter of 2,800 miles, the edge of the ice-cap at any point being thus about 1,400 miles from the South Pole. Its thickness at the edge, where it enters the sea, may be taken at not less than 1,400ft., for icebergs, whose total thickness would several times exceed this amount, have frequently been seen floating from it northwards. From the edge the thickness must gradually increase to the South Pole. A slope of half a degree would give a thickness of twelve miles of ice at the Pole, which is probably a very low estimate. Dr. Croll then applies these facts to the consideration of the last glacial epoch in the northern hemisphere, insisting that the magnitude of the ice-sheet which then enveloped Scandinavia and the British Isles has been much underrated. In an appended note he states that two of the officers of the Scotch Geological Survey, Messrs. B. N. Peach and J. Horne have lately found unmistakable proofs that the Shetland Isles were glaciated by land-ice from Scandinavia.

NEW GEOLOGICAL FORMATIONS.—Dr. Henry Hicks now recognises three formations in Wales of earlier date than the Cambrian rocks. The beds which form them were mapped by the Geological Survey, either as igneous, or as altered Cambrian or Silurian rocks. In Pembrokeshire he distinguishes beneath the Harlech (Cambrian) group a mass of volcanic breccias and ashy schists and slates, perhaps 8,000ft. thick, on which the Cambrian beds repose unconformably. For this series Dr. Hicks proposes the name *Pebidian* from Pebidiauc, the name of the division or hundred in which these rocks are mainly exposed. They in their turn rest unconformably on compact quartz schists, chloritic schists, and indurated shales with beds of dolomitic limestone. The base of these beds is not seen, but they have a very high dip, and the thickness exposed is estimated at 15,000ft. Dr. Hicks has named them *Dimetian* from Dimetia, the ancient name for a kingdom which included this part of Wales. In 1877 the presence of both these series of rocks was proved in Caernarvonshire, in North Wales, and at the last meeting of the Geological Society, (Feb. 5th, 1879,) Dr. Hicks stated that he had ascertained the presence of a third new group of pre-Cambrian rocks, which forms ridges of quartz-felsite in the neighbourhood of Haverfordwest. They lie between the Dimetian and the Pebidian rocks, and he proposed to name them *Arvonian*. Of course these names are only proposed provisionally, and as a matter of convenience; but there can be little doubt that the great advances made in late years in the study of igneous and metamorphic rocks, together with the introduction of the use of the microscope, will greatly alter our ideas of the nature of many of these old rocks, and will render their thorough re-examination a matter of necessity.

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

THE SECOND ANNUAL MEETING OF MEMBERS will be held at Leicester, on Tuesday and Wednesday, May 20th and 21st. A circular will shortly be issued to all members of Societies in connection with the Union, containing the full programme of this Re-union of Midland Scientists and their friends. The members of the Leicester Literary and Philosophical Society are working hard to make the meeting a success, and the Mayor of Leicester has kindly granted the use of the new Municipal Buildings. The Excursion to Charnwood Forest on the second day, (May 21st,) it is proposed to divide into two parties, one mainly Geological, and the other mainly Botanical, so as to avoid the inconvenience arising from the presence of such a large number in a single party as would render it unwieldy and unmanageable. Full particulars of the proceedings proposed for both days will be published in the May number of the "Midland Naturalist."—EDWARD W. BADGER, W. JEROME HARRISON, Hon. Secs. to the Council.—Birmingham, March 24th, 1879.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—February 25th.—GEOLOGICAL SECTION.—Mr. W. Southall was elected President of the Section.—Mr. T. H. Waller read some notes on "Fluid Cavities, and other Inclosures in Crystals," giving a short sketch of their general characteristics, and of the method in which they have been produced, with some of the deductions which have been drawn from observations made on them. Specimens illustrating various points in the paper were exhibited, and a section of obsidian from Mexico, showing a polarising structure produced by the straining of the glass round some of the included felspar crystals. March 4th.—GENERAL MEETING.—Mr. Thos. Bolton exhibited embryos of trout and salmon, and young *Plumatella repens* and *Fredericella sultana*, emerging from the statoblasts.—Mr. J. E. Bagnall exhibited three mosses—*Fissidens exilis*, from Knowle,

rare in Warwickshire; *Andræa homomalla*, recently added to our British flora; and *Buxbaumia indusiata* from Ballater.—Mr. Lawson Tait read a long and elaborate paper on the gland structures of digesting plants, referring chiefly to the Nepenthes or Pitcher plants, describing the different zones of cells, glandular or otherwise, which line the interior of the pitchers, and the functions which each zone performs in capturing, retaining, or digesting insects. March 11th.—BIOLOGICAL SECTION.—Mr. J. E. Bagnall exhibited *Aulacomnion turgidum*, a moss new to the British flora, and microscopical preparations of other species. Also curious specimens of prolification in leaves of *Cardamine pratensis*.—Mr. T. Bolton exhibited a large collection of organisms from Kinver, including *Melicerta ringens*, *Limnias ceratophylli*, and other rotifers, several species of Infusoria, Radiolaria, &c.—Mr. Cotton exhibited a collection of Foraminifera from Barmouth, and from the winter quarters of the Alert.—Mr. A. W. Wills gave some notes on some of the Unicellular Algæ, dwelling especially on the value of a study of these plants as giving a clear insight into the laws of cell structure and growth, and prefacing an account of the family Palmellaceæ, from which his illustrations were chiefly drawn, by a summary of the views now generally accepted by botanists on the subject of the morphology of the vegetable cell. These remarks were illustrated by a number of specimens, living and mounted, belonging to the genera Protococcus, Chlorococcum, Palmella, Tetraspora, Glœocapsa, Urococcus, Apiocystis, &c. March 18th.—MICROSCOPICAL GENERAL MEETING.—Mr. E. W. Badger exhibited mounted specimen of the larva of Tortoiseshell butterfly, showing the spiracles and tracheal system; also, on behalf of Mr. Fredk. Enock, six beautifully prepared entomological slides, presented to the Society by Mr. Enock.—A cordial vote of thanks was passed to the donor.—Mr. W. G. Blatch, after some remarks on the above, exhibited a minute beetle, *Bryaxis Waterhousei*, found only at the sea-side in a very few localities.—Mr. T. Bolton exhibited living edible frogs *(Rana esculenta.)*—Mr. W. R. Hughes exhibited skin of the common sole (polariscope) and *Artemia salina*, the brine shrimp, an Entomostracan found in the salt-pans at Lymington, Hants, mounted by Mr. Enock.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY.—February 26th.—Mr. W. Russell exhibited and described some Electrotasimeters constructed by himself. Their sensitiveness was shown by their indicating the expansion of a strip of ebonite when breathed upon. March 12th.—Dr. Wm. Hinds read an interesting paper on "Hyphal or Basal Fungoid Tissue." The subject was illustrated by drawings and microscopical preparations.

BIRMINGHAM SCHOOL NATURAL HISTORY SOCIETY.—February 28th.—GENERAL MEETING.—A paper was read by F. Pearson, entitled "Birds and their Nests." Microscopical objects were exhibited by A. B. Badger. Twenty-two new members were elected. March 14th.—GENERAL MEETING.—A paper was read by H. F. Devis, entitled "A Walk round Dolgelly;" mounted specimens of plants were exhibited by him, including the following:—*Impatiens Noli-me-tangere*, *Campanula (Wahlenbergia) hederacea*, *Asplenium viride*, *Linaria repens*. Five new members were elected, who completed the Society's numbers, namely, fifty.

BURTON-UPON-TRENT NATURAL HISTORY AND ARCHÆOLOGICAL SOCIETY.—March 11th.—Mr. J. Charles Cox, author of "The Churches of Derbyshire," read a paper on "The Recent Excavations at Dale Abbey." After giving an outline of the history of the abbey, he gave an account of the excavations. About six months ago there was nothing to be seen but a lofty arch standing in the middle of a large grass field. Mr. St. John Hope happened just before then to meet with a plan of Dale Abbey drawn by Dr. Stukeley in 1730, and he laid the matter before the Derbyshire Archæological Society. It was resolved that the ground should be excavated, and after the preliminary arrangements had been made the work was commenced. After removing about five feet of earth they came to the foundations of the abbey, the walls of which were from two to between four and five feet above the level of the floors. They had now excavated to the boundary of the field, and had discovered the choir, (eighty feet long by thirty-five feet wide,) a double aisle on the south, the foundations of the central tower, north and south transepts, a square chapel, and other buildings on the south side, but the western part had not yet been excavated owing to the

fact that cottages had been built on the site. Four-fifths of the buildings found were of the decorated style of architecture. Mr. Cox then gave a list of the "finds," pointing out particularly the large number of encaustic tiles—some of which were unique, and were found in their original positions—the high altar *in situ* at the east end of the choir, a number of tombs and monuments, the beautiful mouldings, and one large block of Purbeck marble. He described a number of other articles which had been found, and, as he had photographs of some of them and a large map of the excavations, he was able to make the address interesting and explicit. In concluding, he cited several legends attached to the abbey, and appealed to the members of the Burton Society to make the abbey the destination of one of their excursions.

CARADOC FIELD CLUB.—At a recent meeting the following were elected officers for 1879:—President, Rev. J. D. La Touche; Vice-Presidents: Rev. W. Jellicorse, Rev. J. J. Lambert, Mr. Wm. Phillips; Honorary Secretary and Treasurer, Rev. William Elliot. The following Field Meetings were decided on:—Wednesday, June 25th, Coalbrookdale; Wednesday, July 30th, Welshpool; Wednesday, August 27th, The Stiperstones; Wednesday, September 24th, (Special for Cryptogamic Botany,) The Wrekin.

DUDLEY AND MIDLAND GEOLOGICAL AND SCIENTIFIC SOCIETY AND FIELD CLUB.—March 13th.—At a committee meeting, held this day, the following Field Meetings were arranged for, and several new members elected:—April 22nd, Froghall, Cauldon Low, and Cornsall Wood, with the North Staffordshire Field Club; May 20th and 21st, Leicester, with the Midland Union; June 18th, Annual Meeting at Dudley and Frankley; July 24th, Shatterford and Arley Castle; August 22nd, Cheltenham; September 23rd, Sutton Park; October 20th, Bushbury, and Evening Meeting at Wolverhampton.

EVESHAM FIELD NATURALISTS' CLUB.—January 22nd.—The Rev. Canon A. H. Winnington Ingram, F.G.S., read a paper on "The Glacial Deposits of the Vale of Evesham." He divided them into four groups. The oldest, capping the Craycombe and Lench Hills, had been deposited by a marine current from the north, was destitute of animal remains, and composed chiefly of quartzose pebbles, many of which were halves of rounded fragments of transition rocks. The pebbles had been cloven in two probably by the action of intense frost. The next series of drift was also a marine accumulation after an elevation of the land, and was found on subjacent eminences, rising from seventy to 120 feet above the level of the Avon. This gravel is composed of water-worn fragments of older rocks, and includes on Green Hill some very large perfect flints with marks of Glacial Striation, transported, no doubt, on ice from a south east direction. The beds of gravel and sand at Harvington, Norton, and Lenchwick were laid down by the sea after it had retired from the higher ground, and left a wider area for animal life. Bones of the mammoth and other mammalia appear in this drift, and there are signs of a large river from the north having debouched into the marine waters. The gravel terraces occurring on both banks of the Avon were formed by the river when it flowed in a stream more than half a mile broad. The fluviatile origin of these terraces of sand and pebbles is indicated by the occurrence of river shells at their base. The presence of antlers of reindeer, and bones and teeth of the long-haired elephant and woolly rhinoceros, bespeaks a cold climate at the time of their deposition. The association of the teeth and tusks of the *Hippopotamus major*, a congener of which is at present a native of South and Central Africa, with the relics of northern animals, may be explained by the supposition that the bones of the latter were floated on river ice, from a colder territory, or by the hypothesis of intervals of a genial climate occurring in the ice age, more suited to the condition of life of the river-horse, which could not have existed when the watery element in which it delights was frozen over during a great part of the year, and the adjoining land supported only stunted birches and mosses and lichens, the food of the reindeer. Fresh-water shells in a layer of fine sand at the bottom of those highly interesting gravel deposits, near the New Inn at Cropthorne and Little Comberton, testify that they owe their origin to the neighbouring rivulets which formerly flowed in a much larger volume of water, and so seem to afford a corroboration of Mr. Tyler's

theory of the existence of a time of more abundant rainfall, which he styles the pluvial period. The Beckford sand and local gravel beds are proved by the presence of sea shells of boreal type to be of marine formation and the abundance of mammalian remains in them, including *Bos primigenius*, *Bos longifrons*, and *Bison priscus*, and the bones of horses, red-deer and bears in the Cropthorne and Little Comberton drift help to give a picture of the fauna of the period when they were accumulated. No implements used by Palæolithic man had as yet been discovered in the drift of our district, but a very fine polished flint axe turned up from the soil of Harvington, probably by the deeper penetration of the steam plough, testified to the existence of Neolithic man, who after a long interval of time succeeded his Palæolithic predecessor. A slate bracer in Mr. Ingram's cabinet and described by Mr. Evans in his work on stone implements, may have protected the wrist of some Neolithic savage when he directed his arrow against the carnivorous creatures with which he disputed the dominion over the beasts of the field. Mr. Ingram agreed with Mr. James Geikie in considering the existence of the ice age of which our gravels afford indisputable evidence as due to the winters of our hemisphere occurring when the earth was in aphelion, or at its farthest distance from the sun, and not as they do now, when the earth is in perihelion, or nearest to the sun. A contemporary occurrence of a maximum ellipticity of the earth's orbit increasing the distance of our planet from the centre of heat by 8½ millions of miles would necessarily intensify the cold. This astronomical phenomenon happening vast ages ago, and the slow dripping of stalagmite on cave deposits contemporary with a portion of our gravels all agree in corroborating the opinion warranted by the investigation of our drifts, that a period of long duration must have elapsed during their accumulation, disturbance, and redistribution. In fact, if astronomy affords us an insight into the immensity of space, geology offers to our contemplation an infinity of time.—March 5th, Mr. J. S. Slater read a paper on "The Reproduction of Ferns," illustrated by specimens under the microscope.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.—Natural Science Section.—February 28th.—Mr. Henry Hartnell read a paper on "The Mechanical Equivalent of Heat, and How it has been Determined." The terms "work" and "energy," as used by scientists, were explained. "Work" was defined as the production of motion against resistance. "Energy" denotes simply the power of doing work. The principle of the conservation of energy was explained, and examples given of the different forms of energy. The conversion of work into heat, and the experimental methods by which the numerical relation between the quantity of heat and the quantity of work has been determined, were dealt with. In establishing the convertibility of work into heat, Joule showed that to raise a pound of water 1°F. in temperature required the expenditure of as much energy as would raise a weight of one pound to a height of 772ft. Joule made experiments in the friction of solids and fluids, in magneto-electricity, and in the condensation of gases. In these experiments the mechanical energy of a suspended weight was transformed, by the friction of a paddle rotating in water, into heat, and the temperature of the water raised. Iron discs were rotated in contact with mercury. Mechanical energy was expended in generating electric currents by induction, which, in turn, were converted into heat, and by comparing the work expended with the heat produced the mechanical equivalent was deduced. The experiments in the condensation of gases gave approximate results. March 7th.—Mrs. Cowen read a paper on "A Ramble in the Inner Hebrides." Starting from Glasgow, steamer was taken at Greenock, through the Kyles of Bute, along the lower part of Loch Fyne, through Crinan Canal, past the Slate Islands, to Oban and the Isle of Mull. At the latter place Loch na Keal and Craig Craiggen were visited. The geology of the Island of Mull was described. The following botanical specimens were gathered:—Bog Myrtle, Drosera, Cotton Grass, and Bog Asphodel. The Island of Eigg was next visited, and the geology of the Scuir described. and illustrated by a photograph taken by one of the party. Specimens of the fossil conifer *Pinites Eggensis* were obtained in the conglomeratic beds beneath the pitchstone of the Scuir. From Eigg the ramble led through the Sound of Sleat, to Raasay, Portree, and Gairloch, and the geology and scenery of the route were described. Mr. J. J. Harris Teall, M.A., F.G.S., gave a description of the microscopic structure of the pitchstone from the Scuir of Eigg, of which the following is an abstract:—The matrix is of true pitchstone, with crystals of

glassy felspar, (sanidine;) some of the specimens have a felsitic matrix. Under a 1in. the matrix is brown and granular, and a banded structure may be seen, probably produced by the movement of the mass when in a viscous condition. The interbedded crystals are of two kinds, 1st, of glassy felspar, which are transparent, 2nd, opaque crystals. The glassy felspar crystals are of irregular forms, triangular, oblong, &c. In some cases the characteristic faces of orthoclase may be recognised. They are traversed by irregular cracks along which, as also along the edges, decomposition in certain cases has set in. The glassy felspar contains the opaque crystals, and also well marked gas cavities. The opaque crystals are more regular in form, and belong to the hexagonal system. I have never seen biotite so opaque, but I am disposed to call them by that name. The whole specimen is traversed by irregular cracks, along which decomposition has taken place. The cracks are filled with a yellowish deposit. When viewed with polarised light and crossed prisms the matrix produces a slight action, showing that it might be more appropriately termed felsite. This action is no doubt due to the great number of exceedingly fine crystals which can be detected under a higher power. The matrix in which these crystals are imbedded may be truly glassy. The felspar shows fine colouration, the prevailing colours being blue, red, and yellow. In several instances the edges of the crystals are surrounded by iris coloured rings, which mark the progress of decomposition. In some cases the glassy crystals contain a number of very fine acicular crystals, probably apatite. This phenomenon is by no means common. The fine acicular crystals are only found as endomorphs along with the opaque crystals. The section of Pinites from the Scuir of Eigg shows all the characters of a transverse section of an ordinary pine. The annual rings are well marked, and turpentine vessels exceedingly rare. The autumn cells are smaller than those formed earlier in the year. The decomposed portions show a rude pentagonal or hexagonal structure, and in the centre is a small portion of tissue still showing the characteristic structure, and from this part radial lines are prolonged.

NOTTINGHAM NATURALISTS' SOCIETY.—February 5th.—The Hon. Sec. (Mr. L. Lee) delivered an address on "Marine Aquaria," in the course of which he described the methods to be pursued for the successful management of aquaria generally. The address was illustrated by diagrams. February 19th.—General Meeting, to receive a report from the committee appointed at the last Annual Meeting to consider the rules of the society. March 5th.—Mr. C. Thornton read a paper on Animalculæ, and exhibited specimens of Hydra. The paper gave interesting particulars of pond-life. It was illustrated by diagrams. Localities were mentioned where animalculæ may be found.

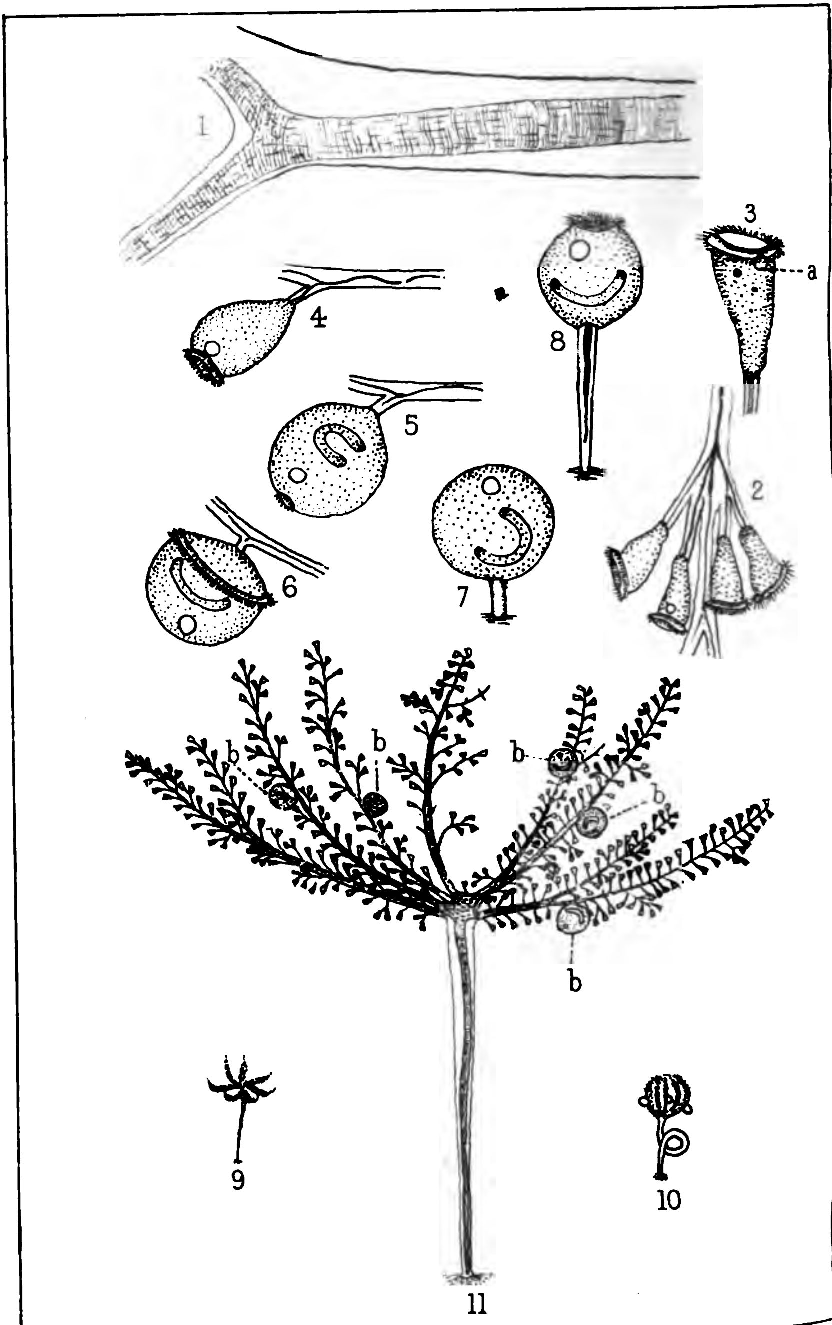
SEVERN VALLEY NATURALISTS' FIELD CLUB.—March 7th.—The Annual Meeting was held at Bridgnorth, when the following were elected officers for the year:—President, Mr. T. Martin Southwell; Vice-presidents: Mr. J. G. P. Smith, Mr. A. Mathias, Rev. A. T. Pelham, and Mr. S. T. Nicholls; Secretary, Mr. Rowland W. Ralph, Honnington Grange, Newport, Salop. Field Meetings as under were arranged:—May 20th, Bewdley, for Habberley Valley and the Severn; June 10th, 11th, and 12th, Barmouth; July 17th, Ludlow.

EXCHANGE.

Coleoptera.—*Anchomenus puellus*, for other local species.—Address, W. G. Blatch, Green Lane, near Birmingham.

Microscopic Slides for Exchange.—Synapta skin; diatoms from New Nottingham, South Jarras, Oran, Kristianstad, Franzensbad, &c.; Helispeltas, Arachnoidiscus, Isthmia, Melosira, &c.; parasites of black rat, mouse, pigeon, &c.; Polar: Naphthaline, sulphate of magnesia and copper, citric acid, stearic acid, &c.; Polycystina, Foraminifera, and anatomical sections stained; also insect slides.—William J. Fuller, Broad Plain Soap Works, Bristol.

Plate II.



Forrest, del.

On the Development of the Vorticellidæ

THE NATURAL HISTORY AND DEVELOPMENT OF THE VORTICELLIDÆ.

BY H. E. FORREST.

[*Concluded from page 89.*]

On Plate II. is figured an exquisitely beautiful animal, *Zoothamnium arbuscula*. It is as rare as it is beautiful, and consequently very little has been written about it. The only complete account extant is by Ehrenberg, in his magnificent work on the Infusoria (page 287.) He states correctly that there are two kinds of bells—large and small; that the colony is umbellate, and that the stem and branches contain a muscular cord. But he also gives many particulars which I cannot confirm, *e.g.*, that the colony is not always umbellate; that the large size of the knobs [Fig. 11*b*] is caused by these individuals remaining longer attached than the others without subdividing; yet he says further that these same knobs divide while still attached. He also mentions the sperm-gland, (*i.e.*, nucleus,) but does not figure it, and states that he has "succeeded in observing the taking of indigo into twenty-two stomachs!" His figure, although splendidly drawn, is not a bit like the object it is supposed to represent. I have attempted to portray Zoothamnium at Fig. 11, but the best drawing possible would be but a caricature of it; the fairy-like grace of its form, and the pure translucency of its whole substance, cannot be reproduced on paper; they must be seen to be appreciated.

The Zoothamnium was first found in this neighbourhood at Barnt Green, on September 21st, 1878, by a party of Birmingham Naturalists, and since that date considerable numbers of specimens have been obtained by myself and others. When, in October last, I exhibited it at a meeting of the Birmingham Natural History and Microscopical Society, I was surprised to find that it was quite unknown to any of the members then present, and I was unable to get a satisfactory answer as to what were the large apple-like cells attached here and there to the branches. My curiosity being aroused, I have since spent a considerable time in investigating their history and anatomy. Although I have not been able to follow them out quite to the end, I thought it better to publish what I had observed than to wait another year to complete my observations. It would be impossible to pursue them to the end this year, (1878,) as the Zoothamnium has quite died down.

The word Zoothamnium is derived from the Greek Zoon, an animal, and Thamnos, a tree. Arbuscula is Latin, and signifies a little tree. The

DESCRIPTION OF FIGURES.—PLATE II. ZOOTHAMNIUM ARBUSCULA.

1.—Muscle from main stem, × 400 diameters.
2.—Portion of branch, × 300 diameters.
3.—Single bell. *a* contractile vesicle, × 450 diameters.
4, 5, 6.—Stages in the development of a reproductive cell while still attached to the branch, × 300 diameters.
7, 8.—Ditto, after detachment, × 300 diameters.
9.—Colony of Zoothamnium, × 2 diameters.
10.—Ditto ditto contracted, × 4 diameters.
11.—Ditto ditto. *b b* are the reproductive cells, × 50 diameters.

names are particularly well chosen, for to the naked eye Zoothamnium present the appearance of a beautiful pearl-white palm or tree-fern, [Fig. 9,] about one-sixth or one-fourth of an inch high, waving gracefully to and fro in the water, and ever and anon contracting [Fig. 10] to one-fourth the size, soon to re-expand in all its original beauty. When submitted to the microscope [Fig. 11] the resemblance to a tree becomes still more striking. We see a long trunk or stem, branching out at the top horizontally; each branch is divided into a number of twigs, thickly studded with minute bells, analogous to leaves. Here and there [Fig. 11 *b*] we have large round globes attached to the branches; these represent the fruit; and to complete the picture there are frequently two or three sprightly Rotifers flitting from branch to branch like birds.

It requires a high power to see the structure of the bells. They consist, as in Vorticella, of a cuticle, a cortical layer, and an internal mass of sarcode. The mode of branching is shown at Fig. 2. The disc is very much elevated, and gives quite a characteristic appearance to the bell [Fig. 3.] Just beneath the disc is the contractile vesicle, [Fig. 3*a*,] situated in the cortical layer.

This organ is found in nearly all the Protozoa, and is very conspicuous in Zoothamnium on account of its large size. It exhibits a regular diastole and systole, but the latter is much more rapid and sudden than the former. When it collapses it becomes invisible, but as it slowly opens it appears like the "stoma" of a plant, and when fully expanded it looks like a hollow globe filled with a perfectly transparent fluid. The expansion occupies nearly one minute, the contraction one second or less. Its function is uncertain; some authors maintain that it is analogous to a heart, and drives some fluid through the body of the animal; others, that it is an organ of respiration, taking in water for that purpose, and then expelling it again. The latter is, I think, the most probable.

On account of the small size of the bells, I was unable to satisfy myself as to whether the contents of the body revolve, as in Epistylis, or not; but I think they do. The bells only work the cilia at intervals, not continuously; and they take a longer time to absorb carmine added to the water, than the other Vorticellidæ. Each bell has an independent stalk, [Fig. 2,] containing a powerful muscle—a branch of that in the main stem. Upon subjecting the latter to a high power I found that it was finely striated, both transversely and longitudinally, [Fig. 1;] and I think this is worthy of notice, as it is the nearest approach to the regular striated muscles of higher animals which I have yet seen among the Infusoria. The stem, however, is not nearly so flexible as in Carchesium, and when contracted it is thrown not into a series of spiral coils, but into a large single coil, as in Fig. 10. The branches are sub-divided into numerous branchlets, bearing the bells, and these are arranged not all around the branch, but nearly all in one plane, so that each branch resembles a fern frond.

Nobody, when examining Zoothamnium, can fail to notice the large apple-like cells [Fig. 11*b*] attached here and there to the branches; and

it is in connection with these cells that we find the most interesting part of the animal's life-history. In many ways they are strongly analogous to the "ovarian vesicles" of the Oceanic Hydrozoa; like them, they are developed as special buds in the colony, larger than the rest; like them, they contain sexual organs, (nucleus and nucleolus,) whilst the other individuals have none; and, like them, I believe, it is these cells alone which are concerned in the production of new colonies. They do not, however, form gemmules in their interior, but detach themselves to form new colonies elsewhere, and in this respect they more nearly resemble the medusa-stage of the Oceanic Hydrozoa.

The way in which they are developed is as follows: One of the ordinary bells [Fig. 3] begins to alter its shape, becoming gradually more globular, and the circle of cilia round the mouth growing smaller [Fig. 4.] The contractile vesicle, which up till now exhibited the regular pulsations characteristic of it, becomes more sluggish in its action, and finally ceases it altogether, remaining permanently distended. The nucleus, which if present at all before, was invisible, is now seen very distinctly near the base of the globe [Fig. 5.] At length the ciliary wreath entirely disappears, but almost simultaneously there appears at the other end a projecting rim encircling the bell, which now assumes the curious shape drawn at Fig. 6. Very soon long cilia are produced along this rim, very feeble and irregular in their motion at first, but rapidly increasing in the vigour and rapidity of their strokes, until finally the bell bursts from its bonds and swims away through the water. When it has found a suitable place it settles down, and attaches itself by its *ciliated* end, and developes a foot-stalk [Fig. 7.] The ring of cilia now disappears, and a third set is formed at the upper end. The stalk rapidly increases in length and developes a muscle inside it [Fig. 8.] This stalk has now the taper form and nearly the same size and thickness as the main stem of the whole colony, [Fig. 11,] and would no doubt produce a new tree by self-division, but I much regret that I have not been able to trace this as yet. It is probable that it remains in the form [Fig. 7 or 8] all through the winter, and does not complete its development till next spring, and I am confirmed in this conjecture by the fact that the mature Zoothamnium is no longer to be found at Barnt Green, while the immature forms are very abundant.

Since writing the above my attention has been called to a quotation from Brightwell's "Fauna Infusoria of Norfolk," in Pritchard's "Infusoria," 4th edition, page 345. This is by far the best account of Zoothamnium yet published, and agrees with my own description given above. Mr. Brightwell has, however, observed one further stage in the development of these "medlar-shaped" bells, as he calls them. He says that he has seen one of them divide into four and another into nine bells, but that these were not like the little ordinary bells, but resembled the large bell from which they originated, and he thinks this may be an instance of alternation of generations. He agrees with me in supposing that these cells remain dormant during winter and reproduce the Zoothamnium in the following spring.

PARASITES OF MAN.*

BY T. SPENCER COBBOLD, M.D., ETC.

[Concluded from page 9.]

ACANTHOCEPHALA.

The thorn-headed worms play a very insignificant part in the *rôle* of human parasitism, and I think that the solitary instance of infection from this source must be regarded as accidental. Considering the character and habits of the intermediary host which harbours the larva of the only species yet alleged to have been found in man, it is even surprising that one case of parasitism of the kind in question should have occurred.

43.—*Echinorhynchus gigas*, Goeze.

Syn.—*Echinorhynchus hominis*, Lambl; possibly *Echin. angustatus* or *E. spirula* (according to) Leuckart; *Tænia*, Pallas; *Ascaris*, Frisch.

Larvæ.—As embryos they are taken (whilst still within the egg) into the bodies of cockchafer-maggots, where, after hatching, they undergo metamorphosis attended with growth.

Int. Host.—This was determined by Schneider to be the larva of the common cockchafer (*Melolontha vulgaris*).

Exper.—Leuckart succeeded in infecting small crustaceans by introducing the eggs of *Echinorhynchus proteus* into fresh water containing living *Gammari* (*G. pulex.*) The eggs were swallowed by the unsuspecting crustaceans. Similarly, maggots of cockchafers accidentally swallow the ova (of *Ech. gigas*) which have been dropped either in pigsties, or amongst refuse on muck-heaps, dung-hills, in farm yards, or in open fields frequented by hogs.

Remarks.—The only genuine instance on record of the occurrence of this parasite (assuming it to be *Ech. gigas*) in man is the case published by Lambl. It was a young worm, measuring less than a quarter of an inch in length, being found in the small intestine of a boy. Undoubtedly it was a true *Echinorhynchus*. A second supposed case in which "an encysted *Echinorhynchus*" was said to have been detected in man is recorded by Welch. Notwithstanding Professor Heller's acceptance of this case as genuine, I am obliged to state that I look upon the *Echinorhynchus* in question as neither more nor less than a sexually immature Pentastome. As regards the adult *Echinorhynchi* of the hog, it may be added that their presence within swine proves exceedingly inconvenient to the porcine bearer, occasionally producing a fatal epizoöty. According to Verrill (in the United States) "the intestine of a hog is sometimes found perforated by so many holes that it cannot be used for the manufacture of sausages."

* Communicated to the Microscopical General Meeting (Birmingham Natural History and Microscopical Society), April 15th, 1879. From Dr. Cobbold's collection Mr. Hughes exhibited an adult male *Pentastoma tænioides* and two examples of the larva (*P. denticulatum*). These had been presented by Professor R. Leuckart. Examples of the leg-sticker (*Stomoxys*) and mosquito (*Culex*), finely mounted by Mr. Wheeler, were also shown. Considered as human parasites, the greatest rarities exhibited on Dr. Cobbold's behalf were bots of *Œstrus hominis* and *Cuterebra noxialis*, and the bot-like larva of *Helophilus pendulus*.

Lit.—Lambl, in Prager Vierteljahrschrift for Feb., 1859; Welch, in The Lancet for Nov., 1872; Schneider, in Archiv für Anat. und Physiol., 1868; Verrill, the External and Internal Parasites of Man and the Domesticated Animals, Connecticut, 1870; Heller, Darmschmarotzer, (l. c., s. 664;) Cobbold, Manual of the Parasites of the Domestical Animals, 1874, (p. 123;) Leuckart (l. c. Bd. II., s. 729, *et seq.*)

Suctoria.

A vast number of suctorial annelids attack man in such a way as almost to deserve the title of parasites. They have been called "free parasites" by Van Beneden, an expression which looks like a contradiction of terms, but which, nevertheless, conveys a very accurate notion of their habits. In this category come the ordinary leeches, besides numerous aberrant forms of leech, some of which have only been imperfectly described. The extent and complications of the subject are so considerable that I am compelled to select for enumeration only a few of the principal species. Many of these pests victimise animals in common with man:—

44.—*Sanguisuga officinalis*, Savigny. This, the green leech, occurs throughout Central and Southern Europe, and also Northern Africa.

45.—*Sanguisuga medicinalis*, Savigny. The grey leech. This has a similar geographical distribution.

46.—*Sanguisuga interrupta*, Moquin-Tandon. The dragon leech. Inhabits Barbary and Algeria.

47.—*Sanguisuga tagalla*, Meyen. The Ceylon leech, of which there are several varieties. They live in woods and damp places.

48.—*Hæmopis sanguisuga*, Moquin-Tandon. The horse leech. Found in all parts of Europe, in Egypt, and throughout North Africa. This species often attacks man in warm climates, introducing itself into the mouth and nasal passages.

49.—*Sanguisuga Javanica*, Wahlberg. The Javanese leech. This species is probably identical with one or other of the varieties found in China, Japan, and other Eastern countries.

50.—*Hæmenteria Ghiliana*, Filippi. This form is tolerably common throughout Brazil.

51—52.—*Hæmenteria officinalis*, and *H. Mexicana*, Filippi. These species inhabit Mexico and Central America.

53.—*Cyclobdella lumbricoides*. The blind leech. This is another Brazilian species which attacks man and animals indiscriminately.

Arachnida.

Amongst the trachearian section of this great class of arthropodous invertebrates, there are numerous parasitic species which attack man and animals. They are more familiarly known as mites *(Acaridæ)*, ticks *(Ixodidæ)*, and Pentastomes *(Pentastomidæ)*. I notice only the more important of them:—

54.—*Pentastoma tænioides*, Rudolphi. In the sexually incomplete state this entozoon infests the liver of man, being commonly spoken of as *Pentastoma denticulatum*. The mature form resides in the nasal chambers of the dog and other animals.

55.—*Pentastoma constrictum*, Von Siebold. Like the former species, this entozoon is found in an immature state in the human liver. It also infests the lungs.

56.—*Sarcoptes scabiei*, Latreille. The human itch insect. This common arachnidan has been described under a multitude of synonyms. According to the highest living authority, Mons. J.-P. Mégnin, most of the so-called species infesting our domestic animals are mere varieties of this species.

57.—*Sarcoptes crustosæ*, Fürstenburgh. The Norway itch insect. In the view of Mégnin this is, at best, a mere variety of the common species.

58.—*Tyroglyphus Méricourti*, Laboulbène. This singular species, furnished with enormous palpi, was found by Dr. Le Roy de Méricourt on an officer who had come from Havannah.

59.—*Demodex folliculorum*, Owen. The face mite. In France, about ten per cent. of the population are victimised by this disfiguring little parasite. The form infesting the dog is only a variety.

60—61.—*Entarsus cancriformis* and *Cælognathus morsitans*. These two arachnidans appear to be genuine human parasites. They were discovered by Hessling.

62—63.—*Argas persicus* and *A. chinche*. These two arachnidans of Persia and Columbia respectively are terrible blood-suckers, the former, which is sometimes called the Miana Bug, having been known to prove fatal to man.

64.—*Ixodes hominis*, Koch. This is probably identical with one or other of the ticks known to infest domesticated animals (*Ix. reduvius*, *Ix. ricinus*, *Ix. nigra*, &c.) It is certain that one or more of these forms have been found on man, occasioning severe pain.

65—66.—*Ixodes monbata* and *Ix. carapato*. These are troublesome species, the former occurring in Angola, the latter in Brazil.

67.—*Galeodes araneoides*. The camel tick. This disgusting and highly venomous species, nearly two inches in length, is very apt to attack man if disturbed.

68.—*Leptus autumnalis*. The harvest bug. This little pest attacks indiscriminately mankind, dogs, cats, rabbits, and probably also many other animals.

69.—*Trombidium cinereum*. The hexapod larva of this or some closely allied species has also been found by Dr. Fox on a child.

70.—*Gamasus*. One or more species belonging to this genus of dung-beetle mites have been found fastened on the human body.

INSECTA.

Instances of true parasitism, partial parasitism, and the so-called "free parasitism," due to insects properly so called, are by no means uncommon in man. Flies, bugs, fleas, and lice come under this category. Only a few forms need be enumerated.

71.—*Blaps mortisaga*. The churchyard beetle. Many perfectly well authenticated instances of the occurrence of this insect in the human body are on record, and I have myself published an instance from facts and specimens supplied by Dr. Horne, of Barnsley. In Pickell's celebrated case, 1,200 larvæ, and also several perfect insects, were passed by the bowel.

72.—*Tenebrio molitor*. The larvæ of this closely allied species have also been occasionally found passing from the human body.

73—76.—*Œstrus hominis.* This insect, in the so-called "bot" condition, and also several others (*Œ. Guildingii*, *Œ. Livingstonii*, *Œ. bovis*,) have been found in man. I stand indebted to Dr. Kirk for the specimen removed from Dr. Livingstone's leg, and which is now in the Hunterian collection.

77.—*Cuterebra noxialis.* This is the well-known Macaco worm. It attacks man as well as animals.

78.—*Anthomyia canalicularis.* The larvæ of this fly are quite common in man. I have myself encountered them, professionally, on six separate occasions.

79—83.—*Musca Cæsar.* This fly is the species which proves so troublesome to sheep. Its maggots, and also those of *M. domestica*, *M. stabulans*, *M. larvarum*, *M. carnaria*, *M. cibaria*, and *M. nigra*, have been found in the human body, playing the part of true parasites.

84.—*Musca vomitoria.* The bluebottle. One or two horrible cases of parasitism from the maggots of this fly were recorded by Sells from Jamaica. In one instance, 235 maggots were expelled from the nostril.

85.—*Lucilia hominivora.* The revolting parasitic habits of the maggots attributed to this species almost exceed belief, but they have been amply attested and described by MM. Coquerel, Vercammer, Bouyer, Dr. St. Pair, and others. Not content with devouring the soft parts at the back of the mouth and nostrils, including the pharynx and glottis, they have been known to eat their way into the sockets of the eye.

86.—*Helophilus pendulus.* Two or three instances are on record of the occurrence of rat-tailed maggots infesting man, and one such instance has been brought under my notice by Mr. Noot, a former pupil of mine.

87.—*Stomoxys calcitrans.* This is the well-known leg-sticker of the Germans, an excessively bloodthirsty fly.

88.—*Hæmatopota pluvialis.* The clegg of the West Highlands. It attacks indiscriminately man and beast.

89.—*Culex anxifer.* The mosquito. Probably many species of mosquito attack man as well as animals. The importance of these insects as intermediate bearers of human filariæ need only be again alluded to.

90—93.—*Chironomus plumosus.* As examples of free-parasites not only the midge, but also many other well-known gnats, may be here enumerated. (*Culex pipiens*, *C. pulicaris*, *C. annulatus*).

94.—*Simulium reptans.* The creeping gnat. This is a very troublesome insect in Sweden.

95.—*Glossina morsitans.* The Tsetse. This notorious insect, made famous by Livingstone's account of its ravages, is terribly destructive to horses, oxen, sheep, and dogs. Its bites, however, though very annoying, do not prove fatal to man.

96.—*Pangonia.* A species of fly referred to this genus is the Seroot or Zimb of the traveller Bruce. Its attacks are excessively painful to the victim.

97.—*Conorhinus nigrovarius.* This insect, known as the Pampas Benchucha, sucks blood like an ordinary tick. Our eminent countryman, Darwin, has told us that in ten minutes this greedy insect, when playing the part of a parasite, "changes from being as flat as a wafer to a globular form."

98.—*Acanthia lectularia.* The bed bug. This well known insect forms a characteristic type of the so-called "free parasites." Without attaching itself to the person, it plays the part of a true parasite by its occasional visits for the purpose of deriving sustenance.

99—100.—*Acanthia rotundata* and *A. ciliata.* These species, of Reunion Island and Kasan respectively, are said to be more blood-thirsty than the common bed bug.

101—104.—*Reduvius personatus.* This fly-bug is abundant in France, and another species *(R. amœnus)* is found in Borneo, whilst others occur in India and elsewhere *(R. serratus, R. cruentus).*

105.—*Pulex penetrans.* The jigger or chigoe. This well-known and excessively troublesome insect is particularly abundant in the West Indies and in tropical America generally. The females attack the soles of the feet, and secure a lodgment beneath the skin. They also attack animals.

106.—*Pulex irritans.* The common flea. As a rule the various species of flea limit their visits to their own proper hosts, but those of the domestic animals are said to attack man occasionally.

107—111.—*Pediculus.* Five distinct species of louse are recognised as human parasites. These are the head louse *(P. capitis)*, the clothes louse *(P. vestimenti)*, the distemper louse *(P. tabescentium)*, the groin or pubic louse *(P. inguinalis)*, and the louse of the eyelids *(P. palpebrarum).*

The lice found on negroes and Greenlanders are thought by some to be distinct forms. I believe the late Mr. Andrew Murray disproved this view. Occasionally one or more species of bird lice have been found on man, and they have been regarded as human parasites. This has occurred particularly in the case of *Ornithomyia avicularis*, ordinarily infesting cage birds. In like manner one or more of the numerous species of lice infesting our common barn-door fowls are apt to attach themselves to horses that are not well groomed, giving rise to that most painful form of Phthiriasis, known to veterinarians under the name of poultry lousiness.

Such is the list of human parasites, entozoal, ectozoal, and free. As far as it goes, I believe it presents a tolerably exhaustive summary of the facts of human helminthism. To be sure, I have said nothing about the protozoal parasites; for I felt that if once these were entered upon there would be practically no limit to the mere enumeration of so-called species. Doubtless the confervoid and simple sarcodic organisms known as *Bacilli, Bacteria, Spirilla, Micrococci*, and so forth, are many of them as truly parasites as any of the higher forms of life we have noticed; moreover, many of them play an equally important part in the production of disease. Besides these, we have parasitic Monads, Psorosperms, Bursarians *(Paramecium)*, and Gregarines, in addition to many other forms, whose position among the Protista is far from being definitively settled. In conclusion, I think the Society will admit that I have only exercised a prudent discretion in limiting my remarks to those creatures which by comparison may fairly be called the higher forms of parasitic life.

RAMBLES WITH A HAMMER.

BY W. JEROME HARRISON, F.G.S.

In writing an account of some geological walks in the midland counties, we wish at the outset to state briefly the purpose of our remarks. Selecting, as far as possible, districts which exhibit typically certain rocks, we propose to point out how these may be best reached and studied in the course of one or more day's walking, describing the sections to be visited, and giving such a general idea of the route as will enable the visitor to have a knowledge of any remarkable objects to be met with on the way.

We shall estimate an ordinary summer day's walk of this kind at from twelve to fifteen miles, a distance which will be found well within the powers of an ordinary individual of either sex. Only those who have tried it can form an idea of the pleasant and thorough way in which a country can be seen in this manner, or of the improvement in health, as well as knowledge, which result from it.

In clothing we advise stout lace-up boots, a light felt hat, and flannel next the skin. A good square-headed hammer is indispensable, as also a small compass and the Ordnance or Geological Survey Map of the district if possible. A good bag, satchel, or knapsack in which to carry provisions, &c., will also be needed; a clinometer, trimming hammer, chisel, pocket lens, and tape measure are of course useful, but may be taken or left according to the special object of the trip; a good plan is to go twice over the ground, on the first visit getting a good idea of the nature and lie of the rocks and the salient features generally; whilst on the second occasion rocks and fossils may be collected, and the sections studied in detail. A note-book and pencil should always be carried.

RAMBLE NO. I.—OVER CHARNWOOD FOREST.

In selecting a region for a first ramble, our thoughts naturally fell upon Charnwood Forest, partly because of the age of the rocks and the accessibility of the district, but more especially because we trust that many of our readers will during this month avail themselves of the annual meeting of the "Midland Union" at Leicester to pay a visit to this remarkable outcrop of palæozoic rocks in the very centre of England. Charnwood lies within the triangle formed by the towns of Ashby-de-la-Zouch, Loughborough, and Leicester. Its shape is an oval formed of hilly ridges trending north-west to south-east, the distance from Gracedieu to Groby being about eight miles, while the width at right angles to this from Bardon Hill to Forest Gate is about five miles. Mountsorrel is an outlying mass on the edge of the Soar Valley, two miles to the north-east, whilst syenitic bosses crop up as far southwards as Sapcote, nine miles from Groby.

The forest area is formed by crystalline and metamorphic rocks, which are, however, at many points covered over by Triassic red marls, the latter running up the valleys in long tongues. The metamorphic

rocks are a great series of volcanic ashes, grits, breccias, and slates, destitute of fossils so far as yet known, and of which the precise age (except that they are certainly pre-carboniferous) cannot be decisively ascertained. These are pierced and disturbed by syenitic masses of later date, and the whole region appears to owe its existence at the surface to an extension of the same upheaving forces which elevated the Pennine chain. An anticlinal line traverses the forest from north-west to south-east, which is also a line of fault. East of this line the strata dip (on the whole) at a pretty high angle to the north-east, and on the other (western) side we find them inclining in the same way to the south-west.

The Midland main line from Leicester to Nottingham affords a fair view of the eastern ridge, while the branch line from the former town to Burton passes along the western side. The line from Ashby to Derby, *via* Melbourne, is of little service to the visitor, as the trains are few and fit in badly.

At least two days are required to "do" the Charnwood rocks properly, of which one should be devoted to the south and east, and the other to the centre and north of the chain. One or other of these may be taken first, according to the direction from which any person arrives; and, of course, either may be begun at the end which is most convenient.

First Day's Walk, from Sileby, by Mountsorrel, Brazil Wood, Swithland, Old John Hill, Bradgate Park, Newtown Linford, and Groby, to Leicester, (thirteen miles.) Getting out at Sileby, (on the Midland main line, seven miles north of Leicester,) we walk westwards through the village, stopping to take a brief look at the fine church (Decorated Gothic, Henry VI.) and the ancient elm tree 30ft. in circumference, which grows in the churchyard. Starting from the church we may either take the north road and first inspect the extensive limestone quarries in the Lower Lias, which lie about halfway between Sileby and Barrow-on-Soar, or, avoiding this detour, which will be about a mile out of our way, take the west road, which leads straight to Mountsorrel. A pleasant half hour's walk across the alluvium of the Soar ends in the main street of the long, narrow village. Turning to the right, we seek the Granite Company's Offices, and obtain leave to inspect the quarry, a request ever kindly granted by the courteous manager, (C. H. B. Hambly, Esq.,) himself a good geologist, and one of the earliest students of the Royal School of Mines. Then, walking up a narrow passage opposite to the offices, we find ourselves in the midst of a scene of great animation. In front rises a grand wall of rock, nearly half a mile long, and about 100ft. in height. On the floor lie enormous blocks of the rock, and in long lines of wooden huts some 600 men and boys are engaged in breaking these up into setts, kerbs, &c. Tiny steam engines, the "Fairy," "Pixy," &c., are puffing up and down, conveying heavy loads to the powerful steam stone-crushers, and carrying finished material by a branch line to the company's siding near Barrow. The rock is a hornblendic granite, consisting of felspar, quartz, hornblende, and a very little mica. There are two principal varieties, grey and pink, the difference being caused by the variation in tint of the felspar. Embedded in the

stone are many darker more finely crystalline lumps, which may, perhaps, be included fragments not quite melted down. A basaltic dyke, known as the "Great Fault," runs obliquely across the face of the quarry from north-west to south-east; it is of a bluish tint, and is overlaid by breccia and "mush," as the workmen style any soft, decomposed rock. Crystals of iron pyrites are common in the granite, and a rather rare mineral, *molybdenite* (called "lead" by the men,) is not uncommon. At the entrance of the quarry the triassic red marls may be seen resting on the granite; they are much ripple-marked, and contain large blocks of stone at their base. Climbing the ridge which bounds the quarry on the right hand or northern extremity, we look over into a hollow containing some fine examples of glaciated rock-surfaces. Ascending the hill we reach the spot once occupied by a windmill, a well-known landmark, removed in consequence of the advance of the quarry "face." Here is a very typical felstone dyke, only about eight inches thick, of a compact texture, and pinkish colour. Several other dykes or veins of similar material occur in the quarry, and are called "salmon" by the workmen. From this point there is a fine view across the Soar Valley to the marlstone ridges of East Leicestershire. The rounded hill to the south-east is Billesdon Coplow, the promontory due east Borough Hill. On the north-west, the great expanse of Buddon Wood lies close at hand, where the lily of the valley still flowers, and where enormous ant-nests excite our curiosity, and send us with renewed pleasure to the perusal of Sir John Lubbock's papers on their habits; beetles, too, are many, and include some rare species. But we must turn to the west and then south-west, leaving this inviting spot on our right, until after walking a mile we reach some cottages, standing on another granitic tor, called Kinchley Hill. Going still south-west we cross a brook by means of a great slab of Swithland slate which forms a capital bridge, and walk along the side of Brazil Wood, until an outcrop of rock in the middle of a field on our right induces us to walk up and examine it. This little knoll is formed of *diorite* (felspar and hornblende.) It is a coarse, dark rock, and excessively tough, as the rock collector will find when he attempts to secure a good specimen. Next we enter the wood on our left by a gate, and stand in front of a small quarry of gneissic rock, while within a few yards there is a final outcrop of Mountsorrel granite. The gneiss and diorite occur at this point only, and to discover their relationship to each other and to the granite it will be necessary to make a small excavation to lay bare the line of junction. Returning to the field path we walk on, noticing Swithland Hall (Lord Lanesborough's seat) on the south-east (left hand,) and in ten minutes enter the village of Swithland, where, if needful, we can recruit at "The Griffin." Continuing our walk westwards we reach the cross-roads, where large deserted slate quarries afford us our first glimpse of the metamorphic series. Standing on the edge of the pit we can discern the bedding and dip (30° E.N.-E.) by means of the *stripe*, or variation in tint of the beds owing to difference of texture and weathering. West of the road are the lovely grounds and house of The Brande, where the late Mr. Alfred Ellis loved to encourage the residence of every wild animal and bird native to

the district (see his letters to the *Times* on the habits of the badgers who made their home here.) Turning to the left hand and going southwards we enter a bye-road which leads through Swithland Wood. Here is a quarry of great depth, (about 250 feet,) worked by Messrs. John Ellis and Sons. The slates are of a dull blue tint, not cleaving so well as the Welsh slates, but producing a roofing material which is practically everlasting. The dip is E. 30°. No fossils, we have already remarked, are known to occur in any Charnwood rocks, yet every student would do well to search these Swithland slates. Prof. Morris once told us that long ago he devoted three days to the task, and felt some chagrin at his want of success; but "never despair" must be the watchword, and it is our firm conviction that these Charnwood strata will yet at some point or other yield us evidence of life. How all-important such a discovery would be it needs no words to point out. Other attractions of Swithland wood are the many rare mosses, and the snakes and blind-worms which may be found by turning over a few of the large stones. Going south, and clambering, if necessary, over one or two stone walls, we strike the straight piece of road which runs up Ling Dale, and which, with its northern continuation to Sheepshed, runs so nearly along the line which separates the eastern and western dips, that it deserves the name of the "Anticlinal Road." Turning to the left (south-east) and walking down this road we reach Holgate (Hall-gates) Lodge, and enter Bradgate Park on the right. The path runs right through this famous demesne, leaving Holgate Hill on the right, and with a large reservoir (140 acres) on the left. Soon we pass the ruins of Bradgate House, once the home of Lady Jane Grey. A little quarry on the left hand (across the brook) shows quartz-grit, and fine slates. Old John Hill, capped by a tower, (a modern erection,) rises on the right hand to a height of about 720ft., its sides and top show well the banded slates so characteristic of Charnwood; they dip 60° south. Close at hand (south-west) is the village of Newtown Linford, where artists flock in summer to sketch the fine "bits" of scenery in the neighbourhood, and where, at the "Bradgate Arms," (Beck's,) every want can be supplied.

Taking the south road, (nearly opposite the little old church,) a mile's walk brings us to Groby Pool, a fine sheet of water, forty acres. Further on is a large syenite quarry (left-hand side of road) where the Triassic marls are very finely exposed, dipping away from the igneous rock. Now we near Groby Village, and observe a mound on the right, the only vestige of the old castle; close by is part of an old manor-house, the residence of Elizabeth Woodville, afterwards the queen of Edward IV. Then turning to the left (east-south-east) we have a four miles' walk over the Trias to Leicester.

Second Walk, from Bardon Hill to Green Hill, High Towers, Charley, Nanpantan, Forest Gate, and Loughborough.

Bardon Station is on the Leicester and Burton branch of the Midland Railway. As many trains do not stop there, it may in some cases be more convenient to get out at Coalville (the next station towards Burton) and join the route here given at the Forest Rock Inn.

The north-east road from Bardon Station leads to the Birch Tree Inn, at the back of which is an exposure of pinkish slates and grits (dip 80° south-west.) Then, making for the tall chimney of the crushing mill, a wood on the right contains a knoll of rock, composed of volcanic breccia, irregular masses of slate, &c., embedded in an ashy matrix. At the entrance of the lower quarry is a bed of finer breccia, and further in a remarkable shale-bed (called a "fault" by the workmen,) and thirty yards further a remarkable rock, (on the left hand,) containing large quartz and felspar crystals. The main mass of the quarry, (which the men call "good rock,") is apparently a highly altered slate. The floor of the upper quarry is sixty feet above the one below, and a path leads thence to the top of the hill, (902 feet,) the highest point in Leicestershire. This is an important trigonometrical centre, and here we see the cairn built by the Ordnance Survey. The view is most extensive, extending to Black Tor in Yorkshire, (fifty miles north-west,) Lincoln Minster, (48½ miles north-east,) Stow-on-the-Wold, (fifty-nine miles south,) the Wrekin, (fifty-two miles west,) the Longmynds, (sixty-six miles west,) &c., and embracing an area of over 9,000 square miles. Facing north-east, the forest region lies spread out at our feet like a map. Markfield Knowl on the right shows its cone eaten half away by the remorseless quarrying to which it has been subjected. We recognise Old John with its tower, whilst right in front rises Beacon Hill. Near the northern foot of Bardon is Green Hill, on which is a conspicuous house having a turret and cupola, (Thos. Nevinson, Esq.) The ridge running to the left forms High Towers, Peldar Tor, &c., and just at its south-west foot runs the great Coleorton fault which bounds the Leicestershire coal-field, the coal seams rising as they approach it till they become vertical. Prof. Hull estimates the "throw" of this fault at 2,200 feet.

Descending the north-west side of the hill through brushwood and fern we quickly reach Green Hill, a porphyritic rock, the embedded crystals of quartz and felspar having probably been ejected from a volcanic vent, a theory which their broken condition goes far to prove. This bed is probably identical with the one already described in Bardon Quarry, and shows that that hill has been thrown forward by a cross fault; the same bed is again seen further north-west at Peldar Tor. Gaining the high road we turn to the left, and then cross a field on the right ascending the High Towers ridge. Here a bed of breccia, containing immense masses of slate, is well exposed; some of these are six feet long, and strangely contorted. A little reservoir is close at hand, Timberwood Hill lies next on the right, and Ives Head is the bold prominence in the north-east.

Walking along the ridge it is just possible that a call at the Forest Rock Inn may be deemed desirable, which will involve a slight detour to the left, (south,) where the inn stands at the cross roads. Returning along the north-east road, we leave on the left the Roman Catholic Reformatory and the well-known Monastery of St. Bernard, (founded in 1835, Cistercian order, buildings designed by Pugin,) and enter a private road on the right, leading to Charnwood Lodge. Here is a wonderful

mass of agglomerate, standing like a wall, and full of fragments of all sizes, the ruins in all probability of some long-vanished volcanic cone. Continuing north-east across the moorland we reach the Hanging Stone, an immense block of breccia, poised on a lower mass; this was once a logan or rocking-stone. The Oaks Church now lies close to on the north; the rocks near it are grey grits and pale slates, (dip south-west.) Keeping to the right we cross Blackbrook, and walk south-east for 1½ miles to the cross roads at Bawdon Lodge, and then turn north (to the left.) Now we cross the anticlinal line, leaving the grassy outline of Charley Knowl on the left; half-a-mile on, and to the right is Whittle Hill, famous for its little quarry in a bed of compact siliceous slate, which yields whet-stones of the first quality, known to workmen all over England as "Charley Forest Hones," (dip east 35°.) Here we are close to Beacon Hill, (south-east,) and can admire its fine outline; its height by aneroid is 850 feet. Regaining the Loughborough road, we walk still northwards, crossing the ridge, and noticing the grand rhododendrons of Longcliff on the left hand; half-a-mile further on we ascend Nanpantan, the little hill on the right, where banded slates are splendidly exposed. Walking on to Loughborough, a deserted quarry on the right-hand shows a volcanic breccia, in which the imbedded fragments of slate, &c., stand out with remarkable clearness from the ashy glistening matrix. From this point it is 2½ miles to the station.

The metamorphic rocks of Charnwood, the ashy slates, grits, breccias, agglomerates, &c., would seem to have been ejected from a series of low cones in the neighbourhood of a tranquil shallow sea, or large lakes. Their total thickness is not much under 10,000 feet. They much resemble the Borrowdale series of the lake district and so may be of Lower Silurian age, but Dr. Hicks has lately found volcanic rocks in his pre-Cambrian (Pebidian) beds. As no fossils have yet been found, and as the oldest rock in the neighbourhood is the carboniferous limestone, which at Gracedieu, on the north end of the forest, is known to rest unconformably on the slates, the age of the latter must remain for the present an open question. The syenitic masses are plainly intrusive, and are therefore of later date. For detailed information the reader should consult an admirable paper by Prof. Bonney and the Rev. E. Hill, "Quarterly Journal Geological Society," Vol. xxxi. p. 754, and Vol. xxxii. p. 199, 1877-78, or my book on the "Geology of Leicestershire and Rutland."

NOTES ON THE HAWFINCH.

The Hawfinch about Derby.—It seems to be the general opinion of ornithologists that the Hawfinch has of late years both extended its range in this country and become more plentiful; see the account of the bird by the late Mr. Henry Doubleday, in the "Magazine of Zoology and Botany," (Vol. I., p. 148,) which is epitomized in Yarrell's "British Birds" (4th ed., Vol. II., p. 99 *et seq.*); and see also the remarks of Professor A. Newton, the editor of that edition, (Vol. II., p. 100,) where he says "Even while compiling the present account of it, the editor has received overwhelming proofs, in addition to

the evidence to the same effect published since Doubleday's paper appeared, of the constant spreading and ever increasing abundance of the Hawfinch." Mr. Stevenson indeed suggests in his most interesting book, "The Birds of Norfolk," (Vol. I., p. 214,) that the frequent discovery of its nests of late years may be due to "The more careful researches of modern Naturalists," but if this were really the true explanation, I think we should hardly find such a careful observer as Gilbert White writing, "Birds of this sort are rarely seen in England and only in winter."

The species is said in Yarrell (4th ed., Vol. II., p. 100) to be still a local one, there being "Yet wide districts in which it is absolutely unknown." Such being the case, I thought a short record of its occurrences in the immediate neighbourhood of Derby might not be uninteresting to the readers of the "Midland Naturalist." I think it may be said correctly that, although the Hawfinch is not a very common bird here, it is a resident all the year round and regularly breeds; it has occurred very frequently this winter.

1.—In the spring of 1874 a nest was found at Littleover, at the top of a small larch about 12ft. high. The nest was composed of dried grass upon a foundation of twigs, the whole was very loosely put together; the eggs were of a dull green, streaked and spotted with a light brownish olive green, and indistinctly with a light purplish colour.

2.—End of April, 1877, a pair nested in the churchyard at Darley Abbey. One of the old birds was shot.

3.—In August 1878 four were shot in Mill Hill Lane, almost in the town, they were male, female, and two young ones. Most likely the old ones had bred in the neighbourhood.

4.—December 12th, 1878, one shot and another seen in Littleover Lane.

5.—1st week in January, 1879, another seen at Littleover.

6.—January 13th, 1879, one caught by a cat at Quarndon.

7.—Several specimens were also seen during the late severe frost, about Belper and one at Spondon Hall, "Journal of Derbyshire Achæological and Natural History Society," (Vol. I., p. 128).

8.—One at St. James' Parsonage Derby, on February 25th, 1879, which, overcoming its usual shyness, fed with the sparrows within two feet of a sitting room window. — *Derby Mercury*, February 26th, 1879.

I may add, in conclusion, it is a thousand pities that this handsome species should be so ruthlessly shot as is generally the case, since, if only a little mercy were shown it, it would probably soon become much commoner than it is at present.—Merlin, Derby, March 16th.

The Hawfinch at Malvern.—The Hawfinch *(Coccothraustes vulgaris)* has been more numerous about Malvern this season than usual. I have heard of it and seen it in small flocks of six to eight in number and have received several fine specimens. This interesting bird was formerly considered scarce in this neighbourhood, but, probably owing to there being more observant eyes than formerly, it is now known to be anything but uncommon; partly too, perhaps, from its natural shyness it has often escaped the eye of the tyro ornithologist. Being naturally a shy bird, it avoids the neighbouroood of man, and hides itself in woods or other secluded spots. Its favorite resort here is a small fir plantation, where it

may be detected by its sharp, shrill note at the approach of danger, similar to *click, click, click*. To get within gunshot of it requires much caution. I have invariably noticed, when I have seen the bird in small flocks, one of them will perch itself on the extreme top of the highest tree, and there act as sentry, keeping a sharp look out. If the flock be once disturbed it is a chance if you get near it again.

I am under the impression the Hawfinch remains here all the year. I have upon two occasions found its nest upon the Malvern Hills, in the fork of hawthorn bushes, about six to eight feet from the ground, and on another occasion at Malvern Wells, in an old apple tree, where, not being disturbed, it reared four young birds, which I saw a few days after flitting about the trees in the orchard. In each case the nest was very carelessly built, and extremely shallow; it seemed scarcely deep enough to contain the bird. It is some years since, while living in Essex, near Bishop Stortford, on the borders of Takeley Forest, that my attention was first drawn to the Hawfinch. It used to visit a fir plantation regularly every year in the month of February. I have seen there from twenty to thirty in a flock. It never seemed to stay longer than a week or so. I once, to my great delight, it being my first year of collecting bird's eggs, found in the forest a nest containing four eggs. On one or two occasions I have dissected the stomach of these birds. In one killed in December, 1878, I found remains of hollyberries, apple, and arbutus; in another, in February last, there were apple and seeds of, I think, the Scotch fir, with four hawthorn seeds. I hope other correspondents interested in this beautiful bird will communicate their observations.—W. Edwards, Malvern.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF MARCH, 1879.

BY W. JEROME HARRISON, F.G.S.

March commenced pleasantly, with dry weather, a rather high barometer, and south-westerly winds. This state of things continued till the 14th, when a radical change took place, the barometer falling half-an-inch in twenty-four hours, and wind shifting to the east. Snow fell to the depth of one or two inches. A rapid recovery, however, took place, and there were a few glimpses of sunshine between the 18th and 20th. From the 22nd to the 28th there were strong north-east winds, extremely cold and dry, very bitter and trying, bearing out the old adage that east winds are "neither good for man nor beast." Snow fell at intervals from the 25th to the 28th. The last three days of the month were warmer with westerly winds.

March was decidedly a dry month. At the majority of stations the total fall did not amount to one inch. The temperature was about 1¼ degrees below the average. There was a thunderstorm near Ludlow on the 14th; lunar halos were seen at Orleton on the 5th and 30th; at Loughborough, 4th and 30th; Stokesay, 31st; Leicester, 30th. The ploughed fields were in good condition for sowing, the frost having reduced the clods to powder; but all gardening operations were very backward. The grass looked brown, and no buds had burst in the hedgerows at the end of the month. At More Rectory blackbirds commenced whistling on the 9th, and wood-pigeons to coo on the 11th, stone-curlews returned very early in the month; at Shifnal rooks began to build on 6th, and ringdoves' coo heard on 17th; snowdrops full out on 4th, crocuses 12th, apricot blossoms 29th, celandine on 30th. At Coventry the note of the little chiff-chaff was heard on the 30th. At Cheltenham bats were seen flying on evening of 19th.

STATION.	OBSERVER.	RAINFALL. Total for M. In.	Greatest fall in 24 hours. In	Date.	No. of rainy d.	TEMPERATURE. Greatest ht. Deg	Date.	Great'st cold. Deg	Date.
GLOUCESTERSHIRE.									
Cainscross, Stroud	W. B. Baker, Esq.	·72	·30	28	6	70·0	19	26·0	14
Cheltenham	R. Tyrer, Esq.	·8	·22	20	14	57·6	19	25·0	2
Stroud	T. J. Coley, Esq	1·02	·32	29	11	55·0	20	24·0	21
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	·89	·17	16	15	51·0	5, 12, 18, (19	23·0	2
Woolstaston	Rev. E. D. Carr	1·35	·50	17	17	61·5	31	24·0	26
Leaton Vicarage, Shrewsbury	Rev. E. V. Pigott	1·04	·39	17	16	57·3	12	21·8	2
More Rectory, Bishop's Castle	Rev. A. Male	1·48	·38	17	18	53·0	18	23·0	13
Larden Hall, Much Wenlock	Miss F. R. Boughton	1·07	·17	15	16				
Bishop's Castle	E. Griffiths, Esq.	1·55	·40	17	15	57·0	7	23·0	13
Cardington	Rev. Wm. Elliott	1·11	·32	17	13				
Adderley Rectory	Rev. A. Corbet	·94	·21	5	14				
Stokesay	Rev. J. D. La Touche	1·21	·31	17	14	57·0	7	28·4	13
HEREFORDSHIRE.									
Stoke Bliss	Rev. G. E. Alexander	·79	·13	28	16	55·0	9	28·0	25
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq	·81	·10	28	1	60·2	9	22·8	2
West Malvern	A. H. Hartland, Esq.	·87	·21	14	11	60·0	9	25·0	23, 24, 25
Pedmore	E. B. Marten, Esq.	·67	·12	16	11	58·0	9	25·0	12
Longlands, Stourbridge	J Jeffries Esq.	·62	·10	28	11	58·0	29	24·0	1 & 13
Dennis, Stourbridge	Mr. C. Webb	·5	·17	16	11	58·5	9	25·5	12
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	·55	·10	15	14				
Dudley	Mr. J. Fisher	·70	·25	16	14	59·0	9, 19, 29, (30	26·0	1 & 13
Sedgley	Mr. C. Beale	·55	·11	16	15	51·0	19	9·0	23, 24, 25
Kinver	Rev. W. H. Bolton	·65	·13	28	14	55·0	19	25·0	1 & 12
Walsall	Mr N. K. Best	·64	·09	28	17	52·0	12, 29, 30	28·5	12, 23, 24
Grammar School, Burton	C. U Tripp, Esq.	·76	·15	16	17	60·0	29	26·0	8 & 14
Weston-under-Lyziard R'tory	Hon. and Rev. J Bridgeman	·96	·34	16	15	58·0	5 & 16	24·5	2 & 13
Wrottesley	E. Simpson, Esq.	·59	·17	16	11	55·5	20	22·5	13
Heath House, Cheadle	J. C. Phillips, Esq	1·10	·30	16	15	57·0	19	25·0	13
Alstonfield Vicarage	Rev. W. H. Purchas	1·57	·3	16	14	55·0	9	20·4	26
WARWICKSHIRE.									
Coventry	J. Gulson, Esq.	·80	·15	29 & 30	15	57·0	20	26·0	2
Coundon, Coventry	Lieut.-Col. R. Caldicott	·75	·16	28	15	57·0	19	27·0	1 & 12
Bickenhill Vicarage	J. Ward, Esq.	·96	·18	28	8	58·0		27·0	
Oscott College	Rev. S. J Whitty	·78	·24	16	13	59·0	19	25·6	13
Henley-in-Arden	T. H. G. Newton, Esq.	·80	·12	16	13	59·0	9	25·0	13
Rugby School	Rev. T. N. Hutchinson	·68	·12	28	12	64·0	19	26·2	13
DERBYSHIRE.									
Buxton	E. J. Sykes, Esq.	2·39	·68	16	15	56·4	9	22·3	13
Stoney Middleton	Rev. U. Smith	1·09	·44	16	13	54·0	19	19·0	7 & 24
Brampton S. Thomas	Rev. J. M. Mello	·78	·21	16	9	61·0	9	2[illegible]·0	8
Fernslope, Belper	J. G Jackson, Esq.	1·36	·34	16	16	55·0	19	26·0	13
Willersley Gardens	J. Tissington, Esq	1·9			8				
Spondon	J. T. Barber, Esq	·94	·31	16	13	56·0	29	24·4	12
NOTTINGHAMSHIRE.									
Tuxford	J. N. Dufty, Esq.	·68				54·0	19	25·0	12
Hodsock Priory, Worksop	H. Mellish, Esq.	·88	·14	16	15	59·1	29	26·4	14
Park Hill, Nottingham	H. F Johnson, Esq.	1·14	·27	16	14	56·9	19	29·0	12
Hesley Hall	B. J. Whitaker, Esq.	·93	·21	17	12	61·0	12	27·0	14
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	·70	·14	16	16	61·2	19	26·7	13
Ashby Magna	Rev. E. Willes	·79	·21	29	13	61·0	19	26·0	11
Market Harborough	S. W. Cox, Esq.	·83	·15	28	13	57·0	19	28·0	11
Kibworth	T Macaulay, Esq.	·71	·16	28	13				
Town Museum, Leicester	W. J. Harrison, Esq.	·68	·1[illegible]	28	14	61·0	19	26·6	8
Belmont Villas, Leicester	H. Billson, Esq.	·70	·1[illegible]	28	14	64·0	19	27·8	13
Syston	J. Hames, jun., Esq.	·65	·16	28 & 30	8	65·0	20	27·0	13
Waltham-le-Wold	E. Ball, Esq.	·94	·13	16	14	56·0	19	24·0	12
Little Dalby Hall	G. Jones, Esq.	·67	·13	30	14	63·0	19	22·0	13
Coston Rectory, Melton	Rev. A. M. Rendell	·68	·11	30	14	60·0	19	21·5	2
Belvoir Castle	W. Ingram, Esq.	1·0[illegible]	·26	31	16	60·0	20	25·0	13
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	·80	·19	30	13				
Castle Ashby	R. G. Scriven, Esq.	·90	·18	29	12	58·0	7	25·0	12
Kettering	J. Wallis, Esq.	·92	·12	29	11	57·0	20	27·0	13
Althorpe	C. S. Groom, Esq.	·63	·10	31	14	57·0	19	25·0	2, 8, 9
Pitsford	C. A. Markham, Esq.	·88	·11	30	18	62·0	19	25·0	12
Northfields, Stamford	W. Hayes, Esq.	·97	·40	18	10	60·0	29	26·0	2
Ventnor Hospital	H. Sagar, Esq.	·73	·20	18	12	57·6	9	31·5	25
Altarnun Vicarage	Rev. G. Tripp	1·[illegible]7	·3[illegible]	19	18	64·0	20	25·0	2 & 14

METEOROLOGY.—I should be much obliged if some one would tell me the name of a good and comprehensive text book on general Meteorology, tolerably up to date. It must be in either French or English.—H. M.

SPRING FLOWERS.—In March I noticed Whitlow Grass in flower on 8th, Coltsfoot 10th, Chickweed 12th, *Cardamine hirsuta* 17th, Lesser Celandine 27th, and *Saxifraga oppositifolia* on 30th.—Stroud: S. J. C. Chickweed flowered on 8th, apricot on 30th.—Burton-on-Trent: C. U. T.

Microscopy.

Mr. Sharpus's Method of Mounting.—Mr. Sharpus, an amateur microscopist, of London, and an esteemed corresponding member of the Birmingham Natural History and Microscopical Society, has lately presented to that Society specimens of his microscopical preparations of Echinoderms and other objects.

All these objects are so remarkable for their exquisite beauty as microscopical preparations, that they are valued by the Society as perfect models of what such objects should be. Mr. Sharpus has, therefore, been asked to give, for the benefit of our readers, an account of the means by which such admirable results were obtained, and he has kindly acceded to the request. Perhaps the most noticeable for beauty are the minute star-fishes, *Ophiocoma rosula*, *O. neglecta*, and *Asterina gibbosa*. About these Mr. Sharpus writes:—"It is imperative that they be prepared immediately they are taken from the sea. They must be killed by being plunged into *cold* fresh water, and then placed in weak liquor potassæ. The time for remaining in this varies so much with different specimens that it is impossible to say anything more definite than that care must be taken to remove them before they show signs of breaking up; then wash repeatedly in distilled water, and dry on blotting paper, in sunshine if possible. No pressure must be used. Mount either as dry opaque objects, or in balsam."

As to the Pedicellariæ of *Uraster rubens*, and *U. glacialis*, the directions are:—"Remove a ray and macerate it in liquor potassæ till the 'pedes' leave the skin upon the liquor being agitated; wash in distilled water, and select the most perfect specimens for mounting. They can be fixed to the slide with gum tragacanth, to which has been added a little gum acacia. The pedicellariæ and ambulacral discs of Echinus may be obtained from a specimen that is dried. Treat with liquor potassæ, but with extreme care, lest the segments of the calcareous disc separate." Amongst the objects presented were heads of Vanessa, Bombyx, &c., which were singularly clear and perfect. Of these Mr. Sharpus says:—"They were boiled in weak liquor potassæ until the pigment in the eyes, and all else that could be dissolved, had disappeared; they were then washed, and boiled in distilled water for five minutes. They are mounted in glycerine."

"Palate of Buccinum was placed in liquor potassæ for a day, or a little more, then washed in distilled water, stroking it with a sable brush, in the direction of the teeth, to clean it."

Mr. Sharpus assures us that extreme care, great patience, and some little experience are the essentials of his success in the mounting of these objects, and that with these essentials, and perseverance, equal success may be attained by any one.

It will interest our readers to know that, so long ago as 1875, Mr. Sharpus exhibited to the Birmingham Natural History and Microscopical Society preparations of *Ophiocoma neglecta*, which he believed proved that that star-fish certainly was viviparous. Mr. Hughes, F.L.S., read before the Society, on the 16th February in that year, a paper upon these preparations, describing their peculiarities, and pointing out the extraordinary nature of the fact which these specimens seemed to prove. So startling, however, was the assertion that a star-fish could be viviparous, that the Society dared not accept it fully from the evidence then laid before them. The observations of Sir Wyville Thomson, which have since been published, prove that Mr. Sharpus was right in his conclusions, and that certainly he was one of the discoverers of this astonishing fact in the life-history of Ophiocoma. JOSEPH BRAGG.

Freshwater Life.—Mr. Bolton's little "tubes" only need to be known to be more generally subscribed for. The other evening we had the contents of four different tubes under observation, and we could not help wishing that all our readers who own microscopes would put themselves in communication with Mr. Bolton, (17, Ann Street, Birmingham,) and get a supply of the good things he is continually distributing over the country. One tube contained a colony of *Plumatella repens*, most of them emerged, others just in the act of emerging from the statoblasts. Who that has seen the lovely lophophore of this beautiful polyzoon needs any description to recall it, and what words would give an adequate idea of it to those who have not? In another tube there was a supply of *Nitella translucens*, (in which the circulation of the sap was visible,) to which were attached innumerable bunches of *Carchesium polypinum*, so well described in our last number by Mr. Forrest. A third tube contained another kind of Carchesium, much like an Epistylis, which, so far as we know, has not yet been described. There were also specimens of *Paludicella Ehrenbergi*, *Limnias ceratophylli*, *Hydatina senta*, *Euglena viridis*, and numerous other interesting objects. We warmly advise all microscopists to subscribe to Mr. Bolton for a regular supply of living freshwater objects, which he distributes in a manner rendering their examination as easy as it is possible to be, for he usually forwards with each tube illustrations and descriptions of the objects, which are invaluable to those who are unacquainted with the objects sent.

Correspondence.

Snow Flakes.—Whilst walking home on the 26th of March, about one in the morning, snow began to fall very gently, but instead of the usual powdery or feathery appearance, each flake consisted of a distinct plate, in some cases perfect six-pointed crystals. I measured some of the plates, and the largest were as much as ⅜in. across. On taking up a handful the appearance was most peculiar. Instead of the white opaque body one usually sees, the mass was pearly, and although very familiar with Boracic acid, I should have found some difficulty in deciding between a handful of that body and the snow. The effect near the lamps was very beautiful, more especially as the road became covered, the ground appearing covered with luminous points, which scintillated like stars as one walked along, whilst the falling crystals reflected iridescent hues. The effect in the country, on igniting some magnesium wire, was very brilliant. It was a cold dull night, barometer falling.—F. E. L., Burton-upon-Trent.

Black Band in the Drift.—I have recently noticed a curious bed in the drift, near Birmingham, of which a short account may be interesting. It occurs in a new railway cutting at Washwood Heath, on the Birmingham and Coleshill Road, and consists of a black band of about four to six inches in thickness. It appears to resemble peat, for it dries brown, and contains sufficient vegetable matter to make it burn in the fire. Traces of vegetable structure can be seen with a lens, but it is not very distinct. Above this bed lie about twelve feet of sand, and it rests upon a thin bed of white, tenacious clay. Below this is a thick bed of sand and pebbles, of which the thickness cannot be seen, but which evidently reposes on the red marl of the Triassic system. The black band terminates rather abruptly towards the north, but the excavation has not been carried far enough, as yet, to show how far it extends in other directions. I have never met with a similar formation in the drift, but should like to know if it is a common occurrence.—A. H. Atkins, Birmingham.

POLLEN OF THE HAZEL.—Examining the pollen from the cultivated hazel in my nuttery (the Fill-basket variety) with a magnifying power of about 400 diameters, I find that although when dry the grains look nearly all alike, when moistened with water they vary greatly. Three distinct forms are distinguishable, two of which (I will call them A and B) are triangular in shape and show three projections of the *intine*; but while A is of equal transparency throughout, B has only the projections transparent. The third form (C) is slightly larger than the others, the triangular shape of A and B is but faintly indicated, the projections of the *intine* are not developed, but there is a distinct granular opaque nucleus in a transparent sac. I conclude that these variations are due to differences of ripeness in the pollen-grains; that in C, the growth of the *intine* being less advanced, the absorption of water has swelled the *extine* and caused a separation between the two tissues, leaving the *intine* as a central nucleus; while in A and B, the *extine* being already broken through at the three angles, it is the *intine* which has absorbed the water and so increased the prominence of the projections. The difference between A and B consists probably in this, that A being a little riper the *intine* has burst at the three projections and discharged the granular *fovilla*, leaving only the transparent sac. On close examination a slight raggedness may be seen at the apex of each projection in A.—F. T. MOTT, Birstal Hill, Leicester.

NOTES ON ORNITHOLOGY.—During the past severe winter our usual winter visitors disappeared in a very marked way. At the commencement of the frost, on the 7th December, Fieldfares and Redwings were unusually abundant, Starlings also were as numerous as usual. After the frost had lasted a fortnight, all three disappeared entirely and were no more seen until the frost fairly broke up. This did not take place until the 2nd February, so that during eight weeks I did not see a single specimen of either genus. As soon as the frost broke up, and they could hunt for their food on the grass, the starlings returned at once, but the fieldfares were not seen again till the 15th February, and since that time have only been occasionally observed, and in very small flocks. The same may be remarked of the redwings. There is no one of our migrants which remains with us so long as the fieldfare; arriving about the third week in October, I have observed it passing on its return journey as late as May 10th, (1877,) a period of nearly seven months. On 29th March I heard the welcome voice of our first arrival, the Chiff-chaff. This was followed on the 4th April by the Blackcap. On the same date (4th April) I saw a Wheatear, and on the 7th I heard the Wryneck. I see in the last number of the "Midland Naturalist" a report of the Wryneck being heard in Oxfordshire on the *6th March*. Without for one moment suggesting a doubt of the accuracy of the observation, it would be interesting to know whether the bird was *seen* as well as heard, as the date is at least three weeks earlier than usual. In this county it never appears earlier than the first week in April, and generally later, preceding the Cuckoo, whose "mate" it is, only by a few days. In the "Birds of Oxfordshire," published about thirty years ago by the Brothers Matthews, in the "Zoologist," they give the date of the arrival of the Wryneck in that county as from the last week in March to the third week in April. If the bird were not seen, but only heard, I might suggest the possibility of mistaking the call-note of the Kestrel during the pairing time, (which would correspond to the date mentioned,) for the note of the Wryneck, from which it would be very difficult indeed to distinguish it. On the 29th March I observed three Dotterel on a newly-turned fallow near Kibworth. These birds are rarely seen here.—T. MACAULAY, M.R.C.S.L., Kibworth.

BUZZARD IN NORTH NOTTS.—It may interest some of your readers to know that a common Buzzard (*Buteo vulgaris*) was killed near here on

April 3rd. The bird had been constantly seen in the neighbourhood since Christmas; it frequently took rabbits from the keepers' traps. The only spring migrant which I have noticed as yet was a Willow Wren (*Phylloscopus trochilus*), or Chiff-chaff (*P. collybita*), I am not quite certain which, on April 5th. Very few signs yet of birds beginning to build.—H. Mellish, April 8th.

Abnormal Hen's Eggs.—Noting a paragraph on the above subject in your last number, I was led to hunt up a note concerning an egg laid by a Brahma fowl last September. The egg was 3⅜in. long by 2¼in. diameter. On breaking it was found to contain another egg in a perfectly sound shell, measuring 2¼in. long by 2in. diameter, the intermediate space containing only white albumen. The inner egg was complete and in no way differing apparently from an ordinary egg. The same fowl has laid many very large eggs, mostly double-yolked, both this season and last.—F. E. L., Burton-upon-Trent.

Correction.—In my notes in the April number, page 102, I made some remarks on geese, which it would be better for readers to erase altogether, as some confusion has arisen as to species.—O. V. A., (Bodicote, Oxon,) April, 1879.

Gleanings.

The History of Coal.—This is the title of an excellent lecture by the Rev. Thos. Wiltshire, M.A., F.G.S., published by Spon, (price one shilling.) It gives in a thorough, yet concise and readable manner, an account of this important mineral, as known to the ancients, and also all that is known as to its use and development in Great Britain.

Lichens.—Mr. Charles Larbalestier, B.A., proposes to issue during the ensuing summer and autumn fasciculi of the Lichens of the Channel Islands, England, and Ireland. Many of the species will be new to science or extremely rare. For particulars apply to the Author, Roche Vue, St. Aubin's, Jersey.

Pollen.—A comprehensive and valuable paper on the subject of "Pollen" was recently read at Natal, before the Natal Microscopical Society, by Mr. Maurice S. Evans. A copy of this paper has been sent to us by the Secretary. We congratulate our distant microscopical friends on having among their members such good original workers in science as the author of this paper.

Duration of Life.—We quote the following from the Proceedings of the Geologists' Association (Vol. V., p. 336.) At a meeting at the British Museum the keeper of the botanical department, Mr. Carruthers, "informed the members that he had revived Bauer's specimens of the minute annelid, *Vibrio*, known as the 'paste eel,' after it had been 'pectously dead' for sixty years." This is the finest instance of "revivification" which we have yet come across, and one might incline to feel sceptical were it not that the high scientific reputation of Mr. Carruthers forbids such an idea.

The Yorkshire Naturalists' Union commenced the season of 1879 by a visit to Ingleton, on the 14th of April last. A special train from Leeds and Bradford conveyed about sixty members. Ingleton is situated at the confluence of two mountain streams which drain the slope of Greygreth, (2,250ft.,) Whernside, (2,414ft.,) and Ingleborough, (2,373ft.,)

three of the loftiest mountains of the West Riding. The party broke up into sections and explored in different directions, under the guidance of qualified leaders, some devoting themselves to geology, others to botany, and others again to ornithology. The sections reassembled for tea, at the Ingleborough Hotel; afterwards sectional meetings were held, and then a general meeting, at which the Rev. W. Fowler, M.A., vice president, occupied the chair. The sectional reports were then presented.

Gall-making Plant Lice.—The life-history, and the agamic multiplication of the aphididæ have always excited the interest of entomologists, and have even attracted the attention of some of the most eminent of our naturalists. Vol. V. (1879) of the "Bulletin of the United States Geological Survey" contains some biological notes by Dr. Riley, in which he recounts the following remarkable history:—*Schizeneura Americana* is a species of aphis which infests the leaves of the American elm, sometimes in such numbers as to cause all the leaves to fall. If during the winter the cracks in the bark of one of these trees that was badly infested with this leaf-curling species the previous summer be examined, there will pretty surely be found here and there a small dull yellow-coloured egg, about ·5mm. long, probably still covered with the remains of the female's body, quite dried up. Out from this egg, in the early spring, will be hatched the little crawling creature which constitutes the first generation in a very remarkable series. This "stem-mother" begins to feed, and causes the leaf to swell up and pucker until it at last curls over the tiny form. After three moults, and the temperature being warm, it commences to people the leaf with young at the rate of about one every six or seven hours. The second generation, though they never grow to be at all as large as the stem-mother, are like her in many respects. They accumulate in vast numbers, some of which, scattering, form new colonies. Their issue forms the third generation which are destined to become winged. These winged forms are short-lived, but they lay twelve or more pseudova at average intervals of about half an hour. The young plant-lice from these form the fourth generation, the members of which are very active, running swiftly. They are of a brown colour, and are somewhat like in general appearance to those of the second generation. In this stage they swarm over every portion of the tree, and their necessities cause them to migrate, in which effort masses of them get destroyed. The fifth generation is very similar to the fourth. It gives rise to forms like the fourth, but without wings. These give origin to the sixth generation. All of these acquire wings. These abound in the latter end of June and early part of July. They congregate on the bark, seeking out sheltered cracks or crevices, in which they deposit their young. These form the seventh generation, and are sluggish, of the colour of the bark, the females a little larger than the males. They have no mouth. They live for several days without motion. The female seems to increase in size by the enlargement of her one single egg. Both sexes soon perish, leaving among their shrivelled bodies the shining, brownish, winter egg, with which we started; so, after a long series of vegetative reproductions, at last the time comes for the renewing of the race by this zygospore-like body. Surely in this lies a hint to our plant-growers. It would be easier to destroy a single egg than stop a stream of agamic-produced forms extending to six generations.

Roman Glass.—The Leicester Town Museum contains many specimens of Roman glass vessels, but probably none exceed in interest a small fragment of a circular vessel, perhaps a drinking cup, which was found in East Bond Street, Leicester, in 1874, and presented to the

museum by T. Fielding Johnson, Esq. The fragment is 3 inches in diameter, and 2½ inches in height. It represents rather less than one-half of the upper portion of the entire vessel. On a panel, 1⅝-inch in depth, are seen the figures of two gladiators, armed with helmet, shield, and short sword, apparently wearing greaves on their legs, and clothed in short tunics. One lies prostrate on his back, and the other stands near him, in a threatening attitude. The figures are about 1¼ inches in height, and the scene was evidently repeated, perhaps all round the bowl, as a portion of the erect figure can be seen again near the broken edge. On the upper margin of the vessel, above the figures, is the following inscription:—"SPICVLVS COLVMBVS CALM.....VS." The two last letters appear on the left hand side of the fragment, and appear to be the termination of the whole inscription, which probably ran round the entire vessel. In this vessel we probably have the record of some famous gladiatorial contest, the names of the combatants being very likely those recorded on the margin of the vessel. The glass itself is of a greenish blue tint, and is now beautifully iridescent. It must have been blown in a mould, as the figures are in relief on the exterior, with corresponding hollows within. A description of this interesting fragment, together with an excellent drawing by A. H. Paget, Esq., appears in the number lately issued (Vol. IV., Part 4) of "The Transactions of the Leicestershire Architectural and Archæological Society."

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—GEOLOGICAL SECTION.—March 25th.—Mr. T. Bolton exhibited embryo salmon covered with embryo swan mussel. Mr. Crick exhibited pollen of mistletoe. Mr. Lawson Tait presented to the Society a photograph of the birthplace of Dr. Charles Darwin, for which the best thanks of the Society were tendered to him. Mr. Atkins exhibited a specimen of apparently vegetable matter from a depth of 20ft. in the drift sand, just above a bed of clay, in a cutting on a new line of railway near Birmingham. Mr. C. J. Watson exhibited a series of rocks from Charnwood Forest, sent by Mr. W. J. Harrison, of Leicester, as a typical collection for comparison in boulder examination. GENERAL MEETING.—April 1st.—Mr. T. Bolton exhibited *Paludicella Ehrenbergi*, showing the hybernaculum or winter-bud; *Cristatella mucedo* emerging from the statoblast; *Anuræa squamula*, a free-swimming Rotifer; and Stentors, Epistylis, Ophrydia, &c., from Barnt Green. Mr. C. E. Crick exhibited the mistletoe, showing male and female flowers; *Daphne laureola*; and a fasciated stem of Dogwood. Mr. J. E. Bagnall exhibited *Plagiochila asplenioides* from Wylde Green, *Grimmia apocarpa* from near Wolverhampton, and *Chiloscyphus polyanthus* from Sutton Park; also, on behalf of Dr. Braithwaite, *Blasia pusilla*, collected by Jensen in Jutland, showing the gemma-like bodies *in situ*. Mr. C. Pumphrey exhibited *Glyciphagus plumiger*, and some foraminifera from a marsh near Cambridge. The Rev. H. W. Crosskey read a very interesting paper on "The Glacial Phenomena of the Vosges Mountains." BIOLOGICAL SECTION.—April 8th.—Mr. J. Levick exhibited a Stentor of a pink colour, which he believed to be of an undescribed species. Mr. E. W. Badger exhibited a beautiful series of hybrid Primroses (*Primula altaica* and *P. auriculiflora*) and a number of duplex cowslips from Mr. R. Dean, Ealing, and read some notes from that gentleman on the specimens. Mr. J. E. Bagnall exhibited a moss, *Physcomitrium fasciculare*, from Marston Green; also sections of the capsules, shewing columella and band of primary mother-cells, and another section in a more advanced stage, showing the spore mother-cells *in situ*. Mr. T. Bolton exhibited some zoospores of an alga in early stages of development. Mr. W. G. Blatch exhibited several beetles belonging to the Pselaphidæ. Mr. J. E. Bagnall exhibited *Hierochloe borealis*, and gave some notes on its geographical distribution; he also exhibited a number of wild flowers sent from Algiers to Mr. Derrington. MICROSCOPICAL GENERAL MEETING.—April 15th.—Mr. J. Levick

exhibited *Hydatina senta*, and Mr. Bolton *Batrachospermum moniliforme*. Mr. H. E. Forrest exhibited a specimen of the common snake, (*Natrix torquata*,) and pointed out the differences in size, colour, and form of the tail between this species and the viper. Mr. W. R. Hughes read the ninth and last of a series of papers on the "Parasites of Man," contributed by Dr. Cobbold. At the conclusion of the paper a cordial vote of thanks was passed to Dr. Cobbold for his valuable series of papers, and for the many specimens which he had sent to illustrate them. A vote of thanks was also passed to Mr. Hughes for his kindness in reading the papers.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY. —March 26th.—Mons. Z. Camelinat read a paper on "Scientific and Industrial Education in France." He described the various abortive attempts which had been made since the first revolution to impart scientific training to the working classes, and proceeded to describe the two technical schools now actually at work in Paris. The one of these, that of the Boulevard de la Villette, is intended for a model for large industrial towns. The pupils are received at thirteen years, and their average cost to the town is £10 per annum. The other school, that of the Rue Tournefort, will serve as a model for the smaller towns and agricultural districts. Here the pupils are received at eleven years, and cost annually £4. In both the pupils stay three years. The studies consist of general subjects, together with instruction in the use of all kinds of tools. At the end of the second year the student selects his favourite trade, and then devotes the greater part of his time to it, so that when he leaves the school he is able to earn the full wages of a practised workman. It is proposed to make these schools compulsory all over France. April 8th.—A party of the members visited the tar-distilling works of Mr. J. C. Major, Monmore Green. The processes of obtaining naphtha, naphthalene, benzole, carbolic acid, anthracene, creosote, pitch, and other substances were inspected with much interest. April 9th.—Mr. C. E. Crick read a paper on "Plant Life," which was illustrated by numerous microscopical specimens. Good Friday, April 11th.—There was an excursion to the Severn Valley. The party proceeded by rail to Droitwich, and walked thence through Westwood Park to Omberslay. Just outside the park a very interesting quarry in the Keuper sandstone was visited. The rock abounds with carbonised stems of trees, and contains considerable quantities of copper ore. The path through Lord Sandys' park to Holtfleet was then taken, and the valley kept to Hampstall, where tea was provided. After visiting several woods in the vicinity, where some good botanical finds were made, the party recrossed the river and walked to Hartlebury station, having spent a most pleasant day.

CHELTENHAM NATURAL SCIENCE SOCIETY.—April 17th.—At the usual monthly meeting a paper on "The Ideas of Harmony and Symmetry, and the part they have played in Astronomical Discovery," was read by C. H. Hinton, Esq., B.A. The next meeting will be the last of the Session, which has been a successful one.

DUDLEY GEOLOGICAL SOCIETY.—The first field meeting of the year was held on Tuesday, April 22nd, jointly with the North Staffordshire Naturalists' Field Club, at Froghall, under the leadership of Mr. Rigby, of Leek. Between sixty and seventy members of the two clubs, including many ladies, assembled at Froghall, special through carriages being provided by the courtesy of the London and North-Western Railway and the North Staffordshire Railway Companies. Proceeding about half a mile to the foot of the tramway to the Caldon Quarries, the whole party were drawn up the incline. On arrival at the quarry there was, by the kind arrangement of Mr. Fraser, the manager, a tremendous blast of rock, in which 9cwt. of powder was used and about 6,000 tons of stone dislodged, which came crumbling down from the face of an escarpment about 200 feet high. After examination of the fragments the rest of the fine quarry was visited, and at intervals numerous smaller blasts to split the larger fragments took place. The top of Caldon Low was then ascended to see the extensive view. Some specimens were secured of the characteristic fossils and of the various ores, spars, and crystals found in the limestone, which contains crystals of silica, some perfect microscopic specimens of which, about

enough to fill a small thimble, were shown as having been obtained from 3lbs. of the rock dissolved. The descent was then made in the wagons as before, each going independently by its own gravity controlled by a brake. After a meat tea, the club separated, with mutual congratulations on a successful and interesting excursion.

NORTHAMPTON NATURAL HISTORY SOCIETY.—The annual business meeting was held on the 20th March, J. B. Hensman, Esq., in the chair.—Mr. Thomas Bailey, Treasurer, read the balance sheet, from which it appeared that after paying all expenses, including rent, binding of books, periodicals, mounting of photographs, and repaying balance due to treasurer, there was a balance in hand of £8.—The President, (Lord Lilford,) was re-elected, and the Vice-presidents, (Rev. S. J. W. Sanders, F.G.S., Rev. G. Nicholson, and William Hull, Esq.,) were re-elected, the Rev. William Thornton, F.G.S., being added to the number. The committee was re-elected, as were also the sectional officers, the only change being Sir Herewald Wake, president, and Mr. W. S. Godfrey, secretary of the entomological section. The secretaries of excursions are Mr. T. Cordeux and Mr. William Barton. The Secretary was re-elected, and then read a digest of the society's work during the year:—"The progress of the Northampton Natural History Society during its third year's existence has been fairly successful. I purpose, with your permission, to give a short *résumé* of its work. In April, after the publication of our last report, the Rev. H. W. Crosskey delivered a lecture on 'The Glacial Epoch,' dealing in a vigorous manner with the difficulties of the subject, placing clearly before the members the conditions and causes of the glacial drift. Owing to the miserably wet weather of May, but one excursion, an evening walk from Brampton Station, was made, the pleasure of this being marred by the rain coming on, and preventing any work being done. In June, on the first fine day, a wagonette full of members proceeded to Cransley and Broughton, the first halt being at Rushden, where, by permission of W. Clark Thornhill, Esq., the gardens and grounds of Rushden Hall were visited. These are interesting to botanists as being the first locality discovered in England for truffles, and in Morton's history the wilderness is stated to be the habitat of the fly orchis, but on this visit neither of the previously-mentioned plants were seen. The triangular lodge and other objects of interest having been seen, the company proceeded to Rothwell, where the church and bone-crypt were inspected. At Foxhall, the botanists were delighted with exploring a piece of bog land, in which many plants, new records to Topographical Botany, were found. Lamport was made a resting place for tea, after which, by Sir Charles Isham's permission, the party strolled about the gardens of Lamport Hall, the rockery, with its many interesting flowers and ferns, being much admired. The photographical section obtained views of Rushton Hall, Rothwell Church, &c., which were inserted in the album. Evening walks to Hunsbury Hill, Clifford Hill, and Harleston Plain Woods took place during June and July. In August a numerously-attended excursion was made to Fotheringhay, where the castle and moat were inspected, Mr. Holding reading a paper on 'The History of the Collegiate Church of Fotheringhay' in the existing building. A pleasant drive was then enjoyed by Wansford to Burghley, the botanists walking from Wittering to Southorpe, and through Burghley Park to the mansion. After the art treasures had been inspected, the party visited Stamford, from whence, after tea, the company made the home journey. Specimens of *Asperula cynanchica*, *Gentiana Amarella*, *Menyanthes trifoliata*, *Epipactis palustris*, *Schœnus nigricans*, and many other rare plants were obtained. In September, by the kind invitation of our President, a visit was paid to Lilford Hall, and a most enjoyable day was spent in seeing the splendid collection of birds, and examining the beauties of the neighbourhood. Some of the party visited Barnwell Wold, where the wild pear was gathered, and others went to Barnwell Castle and the picturesque village. In the photographic album are views of Barnwell Castle, Lilford Hall, and Lilford Bridge. Besides these excursions, the photographic section made a few special excursions. The opening meeting of the winter session was held in the Guildhall, Lord Lilford presiding, being supported by Sir H. Wake, Rev. William Thornton, and the vice-presidents. Lord Lilford gave an address, but confined his attention principally to the occurrence of the *diurnal raptores*, enumerating, among other species found in Northants, the golden eagle, the peregrine falcon, &c. Mr. Scriven gave the report of the photographic section, and mentioned their intention to photograph the remarkable trees of Northants. Mr. A. Perry said that out of the

sixty-five British butterflies, there was good authority for thirty-eight having been captured in Northants; but his list of moths was but poor, numbering only 180. In botany twenty-three new species and twenty varieties had been found, including *Lythrum flexuosum*, a casual not before reported to occur in Britain, and the roses were also many of them local and rare. The geological report was principally on the magnificent present of the Marquis of Northampton to the town museum. In November, Mr. Beeby Thompson gave a lecture on 'The Lower Forms of Animal Life, and their Physiological Relation to the Higher.' In December, the Rev. W. Thornton, F.G.S., read a most interesting paper on 'The Occurrences of the Northampton Liassic Strata among the Volcanic Rocks of the West Highlands.' In January, Mr. C. Jecks read a paper on 'Darwinism.' In March, Mr. A. J. Richardson read a paper on 'The Age of the Earth.' The microscopical and botanical sections had also had a meeting. The library has been increased by Lord Lilford's handsome gift of twenty volumes of 'The Ibis' and the 'Birds of the West Highlands.' The periodicals, &c., of the society had also been bound into thirteen or fourteen volumes; these can be seen at any time by applying to Mr. Jeffery. The photographs have been mounted and bound in two handsome volumes. An herbarium has been commenced, and includes about 200 specimens. The list of members now contains 105 names, exclusive of some few removed or seceded. It is trusted that the circulation of the 'Midland Naturalist' among the members may increase not only the number of members, but also the love for, and interest in, all branches of natural history. The working up of the various branches of natural history is peculiarly our own subject, and for this object many observers are wanted. The balance sheet compares favourably with that of last year."

NOTTINGHAM NATURALISTS' SOCIETY.—March 19th.—Mr. C. T. Musson read an interesting paper on "The Curiosities of Natural History." March 20th.—Annual soiree at the Mechanics Large Hall. It was a decided success, and gave general satisfaction. April 2nd.—Mr. Musson continued his paper on "The Curiosities of Natural History." April 16th.—An address by Mr. L. Lee (hon. sec.) on "Corals, Living and Fossil," illustrated by diagrams and specimens.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.—NATURAL SCIENCE SECTION.—March 28th.—A lecture was delivered by A. H. Scott White, B.Sc., B.A., F.G.S., &c., on "The Geological History of the Animals of Australia." This was a continuation of the subject lectured on early this session, and after quoting from what was then said, to explain the relation of marsupials to other mammals, the lecturer proceeded to explain that geological history is compiled in nearly the same way as any other history, for although we have no documents to search, yet we have the fossil remains of the animals; and these give us facts more certain than any obtained from writings. The geologist was compared in his task with Dr. Schliemann, who, working on the supposed site of Troy, found traces of five cities which had arisen one after another, and one on the ruins of the other. From each stratum of *débris*, Dr. Schliemann could tell much of the people who had lived in the corresponding city, and when he came to the last stratum he could tell the relative—although not the actual—age of that city. The lecturer proceeded to explain and illustrate the nature of fossils; and inasmuch as in the case of marsupials all the remains consist of bones, the difficulty of the geologist's work was pointed out, and reference was made to Cuvier, the founder of the science of palæontology; of this distinguished man a fine likeness was exhibited. On a "Table of Strata" the positions where marsupial remains have been discovered were pointed out and the localities given *seriatim*, as each set of bones was exhibited by means of slides. The following were the principal examples referred to:—Keuper, *Microlestes* and *Dromatherium;* Stonesfield Slate, *Amphilestes*, *Amphitherium*, *Phascolotherium*, and *Stereognathus;* Purbeck Beds, *Triconodon*, *Plagiaulax*, *Spalacotherium*, and *Galestes;* Gypseous series of Montmartre, *Didelphys*. The lecturer pointed out the similarity not only of the fauna but also of the flora of the Mesozoic period to that which is now peculiar to Australia, and brought his subject to a close by referring to and exhibiting photographs of the remains of the giant pachydermatous marsupials, *Diprotodon* and *Thylacoleo*, which have been discovered in the bone caves of Australia. April 4th.—Mr. E. Smith, M.A., read a paper on

"The Classification of Insects," illustrated by photographic and other lantern slides. Many of the slides were photographed from mounted specimens by Mr. J. Burton, Portland Road, Nottingham, and were much admired by the members. April 14th.—An excursion was made to Stanton-on-the-Wolds, Grimston, and Wartnaby. This was the first excursion of the season, and, owing to the unfavourable state of the weather, a number of members were prevented from joining. Mr. E. Parry, the engineer of the new line of railway now in course of construction between Nottingham and Melton Mowbray, kindly made arrangements for a special train to be placed at the disposal of the party, by means of which the journey was quickly and conveniently made. Starting from Nottingham at ten A.M., Stanton tunnel was soon reached; here the party alighted to examine the deposits of boulder clay in the cutting, and a section prepared by Mr. Parry was exhibited, which showed that in the tunnel (a thousand yards long) and its approaches the whole mass of the hill, to a height of 80ft. above the line, was composed of glacial drift. At the north end of the tunnel is a low outcrop of Rhætic shales, and Lower Lias limestone (10ft. exposed) at a little further south. At the south entrance of the tunnel the drift was well shown in a vertical section of 50ft. to 60ft. in height. The boulder clay is a stiff clay of a purplish brown colour, and, with the exception of an isolated pocket of earthy grit, did not appear to contain any interstratifications of sand or gravel, although, at the north end of the tunnel, a bed of clean, coarse, gritty sand, having a thickness of 14ft., was observed. The majority of rock fragments contained in the clay are more or less perfectly smoothed or polished, and are often beautifully striated. The formation most abundantly represented is the Lower Lias limestone, the rounded blocks being often of large size. Less commonly nodules of fine-grained limestone, from the Rhætics, are found, and these, along with fragments of marlstone, Upper Keuper marl, and fibrous gypsum, may have come from no great distance. Boulders of millstone grit (one of which measured 3ft. in height by 11ft. 9in. in circumference), of encrinital carboniferous limestone, coal measure sandstone, and quartzites, probably from the Bunter pebble beds,—which also occur—must have come from a greater distance, as also must the pebbles of chalk and chalk flints, occasionally met with. This vast deposit appears to have been the result of the action of icebergs or floes, which, drifting along from the east and north became stranded in shallow water, and impinging on the shales of the Rhætic and Lias crumpled and kneaded their soft materials like so much dough, while tearing up, polishing, and striating the blocks of the harder limestone bands which those rocks contain. The engineer states that the surface of the Lower Lias limestone met with in the tunnel beneath the boulder clay was striated *in situ*, the striæ trending in an approximately north-east and south-west direction. Regaining the train the party proceeded to Dalby. Here some time was spent in hunting for Lower Lias fossils in the waste heaps of the Grimston tunnel, and amongst others the following were obtained:—*Gryphæa arcuata*, *Unicardium cardioides*, *Cardinia Listeri*, *C. gigantea*, *Plicatula spinosa*, *Pholadomya ambigua*, *Lima gigantea*, *Ostrea Liassica*, *Crenatula ventricosa*, *Modiola scalprum*, *Pecten*, *Rhynchonella variabilis*, *Terebratula*, *Cerithium*, *Pleurotomaria*, *Serpula*, *Pentacrinus*, *Ammonites*, *Belemnites*, *Montlivaltia Hamiei*, &c. After a visit to a quarry in the marlstone at Wartnaby, the party soon after sought out the "special," and after a rapid run of ten miles reached Nottingham by six o'clock.

STROUD NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.—The annual meeting was held on April 24th. After the transaction of formal business, the President delivered an address. There was a most interesting conversazione and exhibition of a wonderful collection of scientific apparatus, experiments, natural history specimens, &c.

WOOLHOPE NATURALISTS' FIELD CLUB.—The annual meeting was held at Hereford, on April 15th. The general financial statement of the Club was read, and the dates and places of field meetings for the year fixed. The report of the Pomona Committee, with the Treasurer's statement, were also read. After the members had dined together, the President, the Rev. H. W. Phillott, M.A., delivered his retiring address.

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

SECOND ANNUAL MEETING AT LEICESTER,
ON TUESDAY & WEDNESDAY, MAY 20TH & 21ST, 1879.

Annual Meeting.

The Annual Meeting will be held in the Council Chamber of the Town Hall, Leicester, on Tuesday, May 20th, at half-past Three o'clock, the President of the Union (George Stevenson, Esq.) in the chair. The business of the Meeting will be to receive the report of the Council and the Treasurer's accounts; to fix the place of the next Annual Meeting in 1880; to appoint the Officers; to consider any suggestions that members may offer; to discuss the work of the Union during the coming year; and to transact all necessary business. The President will open the meeting with an Address.

Conversazione.

A Conversazione will be held in the Leicester Town Museum, (entrance in Hastings Street,) on Tuesday Evening, May 20th, the arrangements for which are under the direction of the Leicester Literary and Philosophical Society. There will be an exhibition of objects of general Scientific interest, Microscopy, the various departments of Natural History, Archæology, and Art. Members of Societies in the Union willing to contribute specimens, or to exhibit or to lend microscopes, will oblige by at once communicating with Mr. W. Jerome Harrison, Town Museum, Leicester. At intervals, a selection of Instrumental Music will be performed, under the direction of Mr. H. Nicholson.

The charge for admission to the Conversazione will be 2s. 6d. Doors open at half-past Seven. Morning dress. Tickets are now ready, and can be obtained by members for themselves and for friends not members of the Union, through any of the Secretaries of the Societies in the Union; or direct from Mr. W. J. Harrison, Town Museum, Leicester. Tickets can be obtained up to Eight P.M., on Saturday, May 17th, at the Leicester Town Museum.

Excursion.

On Wednesday, May 21st, there will be an excursion to Charnwood Forest. This will be divided into two parties, one of which will be devoted chiefly to Geology, under the guidance of Mr. W. J. Harrison, F.G.S.; the other to Botany, under the guidance of Mr. F. T. Mott, F.R.G.S. The two divisions will leave the Museum together at nine o'clock A.M., in carriages, and will continue together as far as Woodhouse Eaves. They will then separate, the Geological party taking a somewhat wider circuit, and arriving at Newtown Linford an hour later. Both will return together at 6 30, arriving in Leicester at 7 30. A detailed account of the district (together with a map of the route) will be provided for all those intimating their intention of joining the Excursion. See also "Rambles with a Hammer," by W. J. Harrison, F.G.S., at page 117 of this number.

Tickets for either party 7s. 6d. each, including meat tea. Tickets must be applied for not later than Saturday, May 17th, and may be procured from Mr. W. Jerome Harrison, Town Museum, Leicester. Applicants will please to state distinctly whether they intend to join the Geological or the Botanical party.

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

SECOND ANNUAL MEETING AT LEICESTER, MAY 20TH, 1879.

ADDRESS BY GEORGE STEVENSON, ESQ., PRESIDENT OF THE UNION.

If my predecessor regretted that his attainments in science did not sufficiently qualify him to preside over your first annual meeting, pray believe me when I assure you that by an unfortunate coincidence the same cause of regret oppresses me in a double degree. For not only am I rushing into a region where even he fears to tread, but, after reading his address, I know too certainly how much less I am able to direct your inquiries. It is, however, a consolation to me that the success of these meetings and of your organisation depends so much less upon the President for the year, whom chance has given you, than upon the spirit which impels us to unite for local research, and, if possible, to advance the interests of science. It is the more earnest and united cultivation of this spirit in the prosecution of our work that I would respectfully urge upon your consideration. We have an organisation comprising representatives from the active centres of scientific life in the midland districts of England. We have a medium for discussion and correspondence in the "Midland Naturalist," conducted by gentlemen who are not only excellent editors, but themselves able explorers and lecturers. We have, or may have, a fund adequate to such enterprises as the scope of the Union may justify us in undertaking. Our Council has problems of local and scientific interest numerous and important enough to invite and reward co-operation; and all we require is that hearty union and concentrated exertion for selected and specific objects which will, by the convergence of so much power upon them, ensure their attainment. I venture to urge this policy with the more earnestness because it is practical, and may be fruitful; and because little systematic effort in this direction has, I believe, as yet been made. I observe in the "Midland Naturalist" that transactions and reports of some of the Natural History and other Scientific and Literary Societies are collected, but not with much tendency, as to any one subject, to a definite result. Your late President suggested various topics, few of which have left their traces in the pages of our periodical recorder; that of Dr. Spencer Cobbold being an exception, but which had been previously commenced. Now, most of the Societies to which I have referred, if constituted like our own in Leicester, address themselves mainly to supply such general and popular expositions of science as fall within the scope of the average mind and education of the people. But the prosecution of special topics of inquiry or research is relegated in our Society to the section that is organised with reference to the specific subject. In large towns, as in Birmingham, separate societies exist for prosecuting the definite objects in question. But, either through a section of the Society, or the Society itself, a connected series of observations and researches might be undertaken and collected from the Midland district; and,

at the next annual meeting, the subject may be exhausted. The result may be an important contribution to the established facts of science. In any case it can hardly fail to create a larger and more intelligent area for the consideration of those higher problems and ultimate facts on which the world respects the judgment of British scientists. If no such result rewards our ambition, the useful effect may be to make us more thoroughly conversant with the natural history of our own immediate district, to create a body of trained observers, and to revive the love of such pursuits in our elementary schools. The secrets of nature lie scattered in such rich profusion about and beneath our feet, that some scientific treasure-trove is sure to reward our patient research. The microscope and the test-tube have converted the ground we tread, the rocks we climb, and the rivers and seas we fathom, into new worlds of life—"Old and yet ever new"—no longer to be assailed merely with the hammer or sounded by the plumb-line, but to be gently questioned by our finest and most sensitive instruments in order that their delicate tongues may tell in wondrous words "the story of their birth." The exuberance of the minute forms of animal and vegetable life, shown by the highest powers of our instruments, as Professor Huxley graphically states, to defy arithmetic to reckon, affords a fresh and inexhaustible range of inquiry. Indeed, the pleasures of imagination constitute a new stimulus to the pursuit of science, and reward some of its noblest achievements, by suggesting new worlds for conquest.

Let me then give point to these words by urging that during the coming year this Union should undertake the investigation, and, if possible, the solution of a definite subject. Some of my learned and scientific friends, more capable than myself of suggesting problems for useful work, think that you might select subjects for observation with the distinct understanding that at the next meeting the Council shall present a report founded upon such communications as they have received. It has been thought desirable that quarterly meetings of the Societies, or of the sections of the Societies, should be held for the purpose of keeping up and recording the work of the Union. From these, reports should go to the "Naturalist" to be collated by the Secretaries for the Council, who should meet half-yearly, if practicable. In the "Midland Naturalist," (Vol. I., p. 242,) Mr. Harrison has proposed a scheme for exhaustively examining the Glacial Deposits of the Midland district; and the *modus operandi* is very fully shown. The Birmingham Society has already joined in this quest; I trust that by extensive and systematic co-operation the subject may be successfully prosecuted and reported upon at your next meeting.

It has been suggested that as in Meteorology the Union now possesses a band of eighty observers, provided with excellent instruments, regularly reporting the weather, notes of rainfall, and, if practicable, of temperature also, should be taken at the loftiest points of the district. Changes commence in the upper regions of the atmosphere, and are often detected days before they are visible in the lowlands. Rain-gauges should be established on three or four of the Charnwood hills, the Wrekin, the

Malverns, Cotswolds, and other elevations, and our local registrar of the weather would gladly give practical hints as to the character of the instruments most likely to give useful results. Entomology is another subject far from exhausted as to the field for observation in the Midlands. Mr. Frederick Thompson Mott, to whose ability and talent for organisation our Leicester Society and the Union owe so much, advises the investigation of the life-history of some one species of plant or animal, until it is fairly "run down," and he instances the earth-worm, the common Brake Fern, or the migratory Thrushes, as affording ample scope for such an exhaustive treatment to be undertaken by each Society, or the Natural History section of each Society. He also commends to the acuteness of the collective Union the attractive topic of "Vegetable Odours," their chemistry, the conditions under which they are given off, and the functions of them, if any. That such functions exist we no more doubt than that

"Nothing walks with aimless feet."

The question of the causes of colour in plants deserves elaborating, and the dates of the flowering of common plants, and of the appearance of insects and migratory birds generally, would involve small but very useful labour, if accurately observed. It is interesting to find how regularly some people note these things with apparently no idea of connecting their notes with any scientific purpose. It would be a gain to science could we prevail on the multitudes who will tell you of these things to jot them down. Then, when "found and noted," our new facts should be deposited in the "Midland Naturalist" for the ensuing month. The habits of animals present a wide field. The ant-nests of Buddon Wood have an economy and mode of life well worth our study. Sir John Lubbock has only opened a region which is replete with problems of highest interest. So closely do these little beings, and some of our domestic animals, approach, in their marvellous institutions, sagacity, and subordination, the proud confines of human intellect that we may note their habits and capabilities without fear of not growing wiser.

I cannot leave this subject, nor could the Union meet in Leicestershire, without paying a tribute of respect to the memory of a gentleman who has been so distinguished by his pursuits in Natural History as Mr. Alfred Ellis, who has so recently passed from our midst. Belonging to a family highly esteemed amongst us for their support of education and social improvement, Mr. Alfred Ellis added to his other qualities a remarkable interest in the habits and instincts of wild animals, and by a vigilant provision for their wants, succeeded, like his friend, the late Charles Waterton, in surrounding his home at the Brand, in Charnwood Forest, with safe retreats for all manner of persecuted birds and animals. They seemed to appreciate the sympathetic thoughtfulness of their guardian; and the various nooks, rocks, and waters about his lovely forest residence contain many creatures whose prolonged and happy existence rewarded his care. Letters to the *Times* occasionally gave to the public interesting details of their habits, as he observed them, and his active intervention with gamekeepers and others for their protection may be worthily imitated by members of this Union whose influence extends over so wide an area. His memory deserves to be held in honour by all Midland

Naturalists, in whose hands he placed a powerful help when he taught us that there was scarcely one of the so-called inferior natures too wild and refractory to be conciliated by kindness.

As a practical step, it is thought that a model of the district, as worked by each society, would help each section or field-club, and should be constructed on the scale of the largest Ordnance map, (six inches to a mile,) so that the contour of the district and every special spot can be clearly marked.

For Geological members, Leicestershire, in its Charnwood Rocks, offers special attractions. Professor Judd lately told us he had rarely visited a district that comprised, in so small a space, so many illustrations or so much material for study. The points for observation and inquiry set down in the notes for the excursion will furnish topics for comparison with similar formations in other parts of the district. In following the course of the Rhætic beds from the Severn to the Humber, Mr. Harrison has described them as forming part of the strata disclosed in some clay pits on the east side of the town. Striking illustrations of the glacial drift, and of the erratic boulders of the Midlands, are also to be seen near Leicester.

In the name of my fellow townsmen, I beg to give you a hearty welcome to Leicester. In the town you will find that, having built on the earliest foundations of our national life, the ground beneath us is a series of strata, which have been laid successively by ancient Britons, Romans, Saxons, Danes, and Normans. Our Museum has vestiges of each and all of them, and by slow degrees each layer and each race received and shows "its form and pressure." The various convulsions of the social fabric are seen here and there in a rock of one condition or formation of life, protruding through and marking the general crust of the other. So the past in our old town ties itself in with the new. This cannot be altered any more than in the face of nature; and we do not regret it, because it contributes an element of individuality and variety to the scenery of our social life. Perhaps we are not so rapidly overrun with modern ideas as other and newer districts, but we may not part so readily with what is good in older notions. So much for our people. In the town we shall show you, if not the very habits in which our ancestors lived before and during and after the Roman rule, yet the ornaments they wore, the pavements they trod, parts of the fanes in which they worshipped, and the urns to which their ashes were consigned. Mr. Kelly, our eminent local archæologist, will, with Mr. Reeve and Mr. Nevinson, describe them. In the county we shall show you Charnwood Forest, with its microcosm of Geology, and under the guidance of your able secretary you will enjoy a clinical demonstration which the previous researches and speculations of Whewell and Sedgwick, of Jukes, Ansted and Judd have invested with special interest.

Mr. Mott will take such as prefer the Flora of our county through its selected haunts, and tell you all that is as yet ascertained upon a subject he has made his own.

Once more, let me respectfully remind you that it will afford our Society much gratification if the result of your visit to Leicestershire may be such a united and exhaustive treatment of some subject of scientific pursuit as shall make it memorable—if not for some fresh conquest, yet for the increase of that steady habit of local observation and the cultivation of that scientific spirit which must tend to make our information more accurate, and our views more philosophical.

The Leicester meeting of the Midland Union, held on Tuesday and Wednesday, May 20th and 21st, under the presidency of G. Stevenson, Esq., whose address is given above in full, was a most successful and enjoyable one. It attracted a goodly muster of members from nearly all the Societies, who were entertained with unbounded hospitality by their Leicester friends. A full report of the proceedings will be given in our next number. How the visit of the Union was regarded by the local press will be gathered from the following extract from the *Leicester Chronicle* of May 24th:—"The second annual meeting of the Midland Union of Natural History Societies, which took place in Leicester this week, was in every respect a marked success. The attendance at the conference, conversazione, and excursion must have exceeded the sanguine expectations of the promoters; the arrangements fully sustained the strain to which they were thus subjected; the atmospheric influences were propitious and genial—in short, everything combined to render the event as enjoyable as it was fortunate. The Presidential address was a model of what all inaugural discourses should be. Though creditably brief, it gracefully and admirably summed up the *raison d'être of* the Union, and pointed the way to new discoveries and conquests amid the open secrets of field, rock, and wood. The great desideratum in this branch of investigation at the present day is painstaking, persevering, and above all, organized and systematic research. To spread the available fund of talent and energy over the whole of the vast field of enquiry is simply to fritter away inestimable possibilities of usefulness, and court failure. If, therefore, the Union does no more than gather up and concentrate upon a few important problems, the hitherto desultory and discursive labours of our naturalists, it will thoroughly justify its claim to the thanks and support of the community. Research without organization, comprehensive co-operation, and method, must necessarily be alike inefficient and uncertain. But let the Union adopt the admirable plan of concerted action in specified fields of study, with periodic meetings, reports, and comparison, and the investigations will be redeemed from the double evil of confusion and barrenness. The Leicester students of natural history are peculiarly fortunate in possessing within easy reach a storehouse of treasures like Charnwood Forest. It is much to be regretted that the taste for the study is still imperfectly developed, and that only the comparative few of our vast population ever realise the inexhaustible mine of health and wealth which has been placed almost at their very doors. We hope the Midland Union may either directly or indirectly create a popular taste for the sweetest influences of Nature's loveliness. The naturalist, by his pensive rambles

amid field, forest, and wild, derives a pleasure of the purest and highest order. To him a day of communion among the beauties of Charnwood is a source of unalloyed enjoyment and inestimable profit. Such a well-spent holiday expands the mind, invigorates the body, and refines and elevates the heart. The worshipper of Nature returns home in every respect happier, better, wiser, with a rich store of joyous memories to lighten the burden of labour and care amid the struggles and conflict of every-day life."

NOTES ON COLEOPTERA.—II.

BY THE REV. W. W. FOWLER, M.A.

[*Continued from page 94.*]

In my last paper I endeavoured to give a few hints as to collecting and preserving Coleoptera. I now propose to speak of the chief localities in which they may be found.

Beetles are truly ubiquitous. The woods, the fields, the ponds, the streams, all possess their particular species, and even the interior of our houses is not free. The death watch, which has caused so much groundless alarm to superstitious minds, and given rise to so many ghost stories, is nothing more than a tiny beetle of the genus Anobium that burrows in old furniture, and makes the little round holes with which we are all so well acquainted. The clicking noise is produced by the action of its mandibles upon the hard wood, the sound not being audible by day, but plainly heard in the silence of the night.

There is, however, one great exception to the ubiquity of beetles, an exception which makes one hesitate to apply the term to them at all—none have hitherto been found in the sea. In brackish ponds a few yards from the sea (*e. g.* Lymington Salterns) they abound, but in the sea itself there are none. This is the more strange as vegetable life (certainly entirely cryptogamous) is plentiful in the sea. Crustaceans, too, are found in both fresh and salt water, and mollusca also abound in both. It seems strange that although many of the forms of animal life above them as well as below them are found in both salt and fresh water, the Insecta proper seem so carefully to avoid the sea; the explanation is probably to be found in their transformations.

To give any idea of the localities in which the various species of beetles are found would require a volume, and it is impossible in a short article to do more that point out likely places, not for particular genera or species, but for Coleoptera generally.

In doing this it is as well perhaps to classify them roughly under the particular methods and instruments of capture recommended in my last paper.

The Beating Net (an old umbrella serves the purpose thoroughly well.)—The best time for using this is in May and June, though in the early autumn many good things may be obtained. The best trees are

hazels, aspens, oaks, and hawthorns—the latter when in bloom yield a very large number of species. The beating net may be also used to very great advantage in osier beds. Many species of Telephoridæ, (soldier beetles,) Chrysomelidæ, (golden-apple beetles,) and Curculionidæ, (weevils,) always occur in these in abundance.

The Sweeping Net.—This is of use on any warm day from spring to late autumn; but a sunny day, with a warm south wind after rain, will produce a hundred-fold greater result than a very dry day, with the wind even a point or two to the north or east. It is often astonishing what the beetles do with themselves—they are swarming, perhaps, one day, (or even one hour,) and entirely gone the next. If one finds a good thing in plenty it is no good to leave taking more of it until the next day, for the chances are there will not be a specimen to be found. The same rule applies to beating; moreover, during the heat of the day, from eleven or twelve to about four, beetles seem to take a siesta, for trees and plants on which they are abundant morning and evening will be found during this time to have not a single insect upon them, as the writer of this article has found by unpleasant experience. It is very annoying when one has only a few hours, perhaps, in a good place, and has to rush to catch an evening train, to leave a very likely spot just as the good things are coming out.

Damp places are far more productive for sweeping than dry ones. The strips of grass on the edges of cliffs, especially if the field they form a border to happens to be a corn or vetch field and has just been cut, are exceedingly productive. Corners of fields and woods generally abound in species, but a great majority of these species have their peculiar plants, and so a knowledge of Botany, to a certain extent at least, is absolutely necessary for the student of Coleoptera.

The Water Net.—Stagnant pools and running streams alike produce beetles in multitudes, and a little use of the water net will soon give experience in their localities; a tiny puddle in summer will often yield more in a few minutes than a large pond in some hours' work. The Palpicornia are often found in the mud or weeds just at the margin, and should be carefully looked for there; and certain species of Curculionidæ, *e.g.* Phytobius, are semi-aquatic, and are only to be obtained by searching the water weeds. The moss on the edge of waterfalls must also be mentioned, as many beautiful species, not found elsewhere, are found underneath it.

The fern trowel is a very useful implement all through the year, for digging beetles out of sandy banks, (where many of the Geodephaga, especially Bembidia, abound,) for searching at the roots of trees, and also as a bark ripper. Many species are found in old wood and under bark, and it is often inconvenient to carry a large implement; but if one really wants to work wood-feeding beetles, a small strong hatchet is absolutely necessary. A tack extractor also makes a very useful bark-ripper. Old trees on the ground often contain a great quantity of species, and are of course easy to examine; but many of the best wood-feeding beetles are

obtained by sugaring old trees, and so attracting them at night out of their burrows. In winter, sifting old leaves over paper will often produce many rare things, especially Pselaphidæ and Scydmœnidæ. Moss, too, is very productive, and the taller tufts of grass, either in winter or summer, if dug up carefully (here our fern trowel again comes into play) and shaken over paper, will never fail to put something into our bottles if all else fail. The damp bottom layer of a haystack in the coldest weather (as we might naturally expect) will be found, as a rule, full of Coleoptera and Hemiptera.

The grass cut from our lawns and stored in the sun is a very good trap for several rare species—a single hot bed will almost produce work enough for a whole season, and its effect is heightened by putting a little moss in one corner;—the latter is an excellent trap for Euplecti; many people find these hard to get a series of, but I have seen them in numbers by adopting this plan. Dead birds and animals contain Necrophaga in abundance; heaps of decaying sea weed on the sea shore should always be examined, as many species, never found elsewhere, occur in such places, and ordinary species are found in profusion.

When a tree has been cut down in the autumn it should always be carefully watched in the spring when the sap rises, as many species (Epuræa,Ips,Longicornes,&c.,) come to feed on the juice. Old granaries and meal boxes, old houses and old cupboards, old vessels and old sea piles all possess their beetle inhabitants; the small weevils known as granary beetles are amongst the most destructive of our Coleoptera, and often do incalculable harm to stored grain.

There is only one other locality that I would here speak of, and that is ants' nests. Various beetles live in ants' nests and in ants' nests only. The relations that they bear to their hosts are not yet discovered, but they are on the most friendly terms; in fact, on a nest being disturbed, one of the first cares of the ants seems to be for their *protégés*, and they may be seen carrying off beetles larger than themselves to a place of safety.

Midland Naturalists have a very good opportunity of working this group, for the ants' nests abound in Bewdley Forest and elsewhere, and contain many good species.

As a rule there is no doubt that the Midlands have not been so productive of Coleoptera or Hemiptera as the Southern districts and the coasts. This is in a great measure owing to the general character of the soil—for chalk and sand always produce more species,—but there is many a spot and many a district in the Midlands, hitherto unworked, that would prove well worth the labour expended upon it. More workers are wanted, and if they come forward the Midlands will soon be able to bear a very fair comparison, to say the least of it, with the so-called more favoured districts.

AN INTRODUCTION TO THE STUDY OF FUNGI.*

BY THE REV. J. E. VIZE, M.A.

There are very few people who study the interesting plants called Fungi. Hence a leading object in preparing a paper on the subject will necessarily be to try to allure some one onwards to their study, or at all events, if their study would occupy too much labour and research, to unfold a fragment of their importance in the vegetable world, and so to get for them a little more consideration than has been granted them up to the present time.

The wonder is that fungi have been so much neglected, because they would, if studied, fill up many a period of time which now is probably not so well employed. If a man be fond of his microscope, he will detect in them shapes as various as the most ardent lover of change can desire; he will find tints, among the colours of black, brown, and yellow, as gradual and progressive as anywhere; he will notice symmetrical forms as exquisite as gracefulness can be; he will be able to make many a valuable addition to his own knowledge, and confirm the opinions of others, or confute them, by noticing what he sees; he will get a steady progression from one form to another, from one order to another, until he finds how the works of God ramify in every direction, and are all in themselves perfect. There is a rich fund of science coupled with pleasure among the fungi to the man who merely takes his microscope and examines slides under it; but the microscope need not be used merely as a means of looking at a pretty thing; the adjunct of a camera will prove of great service, drawings should be made and always to one uniform scale of considerable magnitude. After making the sketch, the draughtsman may use his talent with the brush, and drive care and idleness away by colouring the magnified drawings on paper from the object still visible under the instrument.

But suppose there be no microscope, and that the privileges just named be not easily attainable, if such a thing be possible in these days, when first-rate instruments are to be purchased at so low a price. Well, of course, a great loss is sustained; but even then there are in fungi forms so large that, at a rough estimate, one-third of the British fungi need no more than the unassisted eye for their examination. Nor should it be forgotten that the present extensive use of the microscope is of recent date, that the pioneers of mycology had not the advantages we have; yet, to the honour of some of them be it said, they often surprise us who try to aspire to their knowledge. Hence none need despair. There is such a vast field of work before us all that the fungi may be worked with or without the microscope; the whole range may be studied at once, or it may be divided and sub-divided, and there will still be work for a lifetime.

See too the advantages attaching to the study of fungi from their being within reach of everyone. If you have a garden attached to your

* Read before the Chester Natural Science Society, February 22nd, 1877.

house, there you are certain to find specimens. Is your house damp? The wall-paper will supply you with an object to examine, possibly three, four, or more, from the same strip of paper. The linen hanging up in your cupboard will supply you, if not moved occasionally. Keep your cheese until it becomes decayed, there will be something to admire in it. Put your hazel nuts away, then see in course of time the beautiful pink that grows upon them. Look at your apples, in those wart-like spots you have fungi again. The diseased house-fly on the windows will furnish specimens, and the cellar is a most prolific spot. But leave home, and go for a walk: the leaves of the trees, the bark, the branches stripped of their bark, will all yield supplies. Go to the lanes, the hedges, the ditches, the inside of a wood, still better the edge of it. Look at the gate-posts, the stiles, the grass under your feet, the corn-field, the decaying sticks, the utterly rotten wood; all these positively invite us at some period or other to study the fungi.

But all is not so smooth as you may perhaps suppose from what you have hitherto heard; there are difficulties to be overcome, *severe difficulties*, and it is only fair that both sides of the question should be placed before you. Let us see then some of the troubles connected with mycology. Pre-eminently stands the want of books with plates of any excellence. There are so few men who study this special department of botany that the inclination to publish dwindles away from want of support. Anyone who attempts it may feel pretty sure that he will not be repaid for his trouble. Also, since few copies of any work that may be published are produced, their value in a number of years becomes proportioned to their rarity. Corda's "Icones Fungorum," by no means costly at first, is now worth £28. Sowerby's "English Fungi" seems to be almost unobtainable. Still, if any one really cares to examine the fungi, the want of books need not deter him; he can make his own drawings, and he can obtain a copy of Dr. Cooke's "Handbook of Fungi," a work which embraces the information contained in Mr. Berkeley's "Outlines of Fungology," and in those valuable papers of Messrs. Berkeley and Broome scattered here and there in the "Ann. and Mag. of Natural History." He can also cope with the times, and the most recent ones too, by subscribing to that record of cryptogamic botany issued every quarter called "Grevillea."

Another difficulty is that of assigning the correct name to a plant. Some fungi are in outward appearance very much like others, the orthodox place of which is very remote from theirs. In fact so difficult is it to say decidedly what a plant is without microscopic help that the higher authorities rarely venture to name anything off at once, or, if they do, it is with the understanding that a critical examination shall be made of it when opportunity offers. Of this we may be sure, that study will unfold the name and place of many a plant which perhaps is unknown for a long time, and of another thing we may be more certain still, that, when it is known that a man really does his best to ascertain his plants, there is such a feeling among the lovers of mycology that every one is ready to help his friend, and give all the assistance in his power.

Now about fungi themselves. What is their place in the vegetable kingdom? How are they especially to be distinguished from their allies? Acknowledging that all lines of demarcation are optional and therefore not necessarily rigid, there are certain means by which fungi are separated from their close companions, Algæ and Lichens. An Alga draws its nourishment through the whole of its surface from the water in which it grows, or the excessively moist place of its existence, which is the same to it as water. Besides this, it is propagated by means of zoospores, tetraspores, &c. Lichens are propagated by means of sporidia contained in asci, also by green bodies, which occur in their frond or thallus, called gonidia. Fungi are propagated by spores or sporidia, and they are nourished from the substance on which they grow through their mycelium. They never have gonidia like lichens. "Their fructification consists either of cells attached externally to threads, which either arise immediately from their mycelium or from a special fructificative tissue, and which are then called spores, or of similar bodies produced in little sacs or tubes, and then called sporidia." A singular fact is observable about fungi, so singular indeed that it has been proposed to assign them a special locality between the animal and vegetable kingdoms; they absorb oxygen and give out carbonic acid; hence in this respect their office seems to be like that of an animal, in confirmation of which you will never find a fungus with the beautiful green colour of vegetables; but, if there be green at all, it is invariably of a metallic tint.

Let us now examine some of the uses of fungi. Amongst other things they assist in destroying vegetable matter which would otherwise be most offensive and pestilential; decaying plants, unless fungi attacked them, would be simply intolerable. M. Roumeguère, in a work published in 1870, called "Cryptogamie Illustrée," gives a list of 220 fungi which grow on the different parts of the *Fagus sylvatica*, and yet the beech is one of the mildest examples we could select, inasmuch as the leaves are anything but fleshy, and their decay would cause less smell than many others when decomposition sets in. How beautifully God has arranged for this decay without injury to our health. The spores and sporidia—in familiar language, the *seeds*—of fungi are wafted through the air in myriads, they are infinitely small, but of such specific gravity that in due course of time they fall and settle on some object. Multitudes of course perish from lack of the exact spot and accompaniments necessary to cause growth. Many begin to vegetate, but their requirements are not there in full, they die in their very cradle. But supposing a spore or sporidium finds everything adapted for it, how does it grow? It does so by means of its mycelium. Moisture, which is essential to the life of fungi, causes a process to start from the spore, which elongates, branches out in all directions, and penetrates even into the hardest woods; and, as it feeds upon the parts that it touches, consumes the matter around it, and so rapidly hastens decay. By this beautiful arrangement, the very substances which are poisons to us form its food. If there were no fungi there would be far more illness.

It is very singular how different forms of fructification proceed from the same mycelium. If a mycelium produced only one form of fruit,

some of the species might be lost, but there is less prospect of such an event now, because from the same low form of fungus will arise one, two, three, four, or more different kinds of fruit, all of which are capable of becoming again the starting points of their species. For instance, there are the dust-like productions called conidia, then the macroconidia, the pycnidia, the stylospores, the ascospores. Many an interesting research has shewn this to be the case, and proof after proof is furnished by those who investigate these things, that the moulds are the forerunners of higher forms of fungoid life. These furnish interesting materials for those who take up the study of fungi. The ease of the study is not increased thereby, but the pleasure and the profit are.

How useful is the vinegar plant. And what is it but a vegetable production, caused by the growth of the mycelium of a fungus *(Penicillium crustaceum)* in saccharine liquor, when not in a state of fructification? The fermentation of the dough of bread is due to the growing of a fungus, by which the bread is made light and wholesome. It is a species of Torula, which forms the yeast; this feeds upon the sugar of the flour and sets free carbonic acid gas all through the dough, and, when it is placed in the oven, the gas is driven off entirely, the fungus is baked, its vitality utterly destroyed, and its remains, which of course do not come out with the gas, are eaten as part of the bread. Thus every day of our lives we are fungus-eaters.

Whilst we have spoken of the uses of fungi, it cannot be denied that there are many instances in which they do great injury. Smut is very often found in fields of corn, although it has now by artificial means been rendered less common than formerly. It destroys the good qualities of the ear at any early period of its growth. Bunt does the same, differing however from smut, inasmuch as its presence is not so easily ascertained. Human beings suffer occasionally from the attacks of fungi. There is a disease from which the natives of India sometimes suffer, called the fungus-foot of India; strange to say, the disease never ascends higher than the base of the leg-bone, just above the ankle. Mr. Berkeley has given an excellent paper on this malady in the "Intellectual Observer" of 1862. The first case he mentions is one in which the bones were "perforated in every direction with roundish cavities varying in size from that of a pea to that of a nut or pistol bullet, the cavities being filled up with a dense fungous mass of a sienna red within, but externally black, and resembling a small dark truffle. From these cavities canals lead to the surface, from which a purulent fœtid discharge is poured out, often accompanied by little pieces of the fungus." Two other kinds of foot fungus are recorded by Mr. Berkeley in the same paper.

In our own country there is a disease to which we are liable, which causes a good deal of unpleasantness rather than pain. I mean ringworm. Ringworm is a fungus, it has its mycelium, and bears its spores, which are very minute and easily conveyed through space. Whether the spores would develop if the skin were perfectly healthy, or whether some weakening cause be needful, is not for me to examine. Insects also are liable to be attacked with fungoid parasites. The silk-

worms in France have suffered severely. Wasps have been seen alive infested with a growth which would eventually deprive them of life. Between twenty and thirty species of ascigerous fungi have been recorded as parasitic on insects. One of our British specimens is very beautiful. It grows in autumn on the pupæ of moths buried in the ground, and is of a splendid orange-red colour, scarcely two inches high, its clavate head being covered with tubercles. The contrast between the scarlet head of the fungus and the green grass in which it grows is very gladdening to the sight of a mycologist who has never before seen it.

The potato disease also is a fungoid growth. A popular idea prevails that the potato disease comes down with the warm rains of summer, and this notion originates in the fact that the leaves are seen to be diseased after the showers of July. When there is a dry season, the leaves are free from the brown spots which indicate the disease. But the rain by no means has the disease in itself; it only causes the spores to grow. Moreover, the spots on the leaves are not the first startings of the disease, they are only proofs that it is at work elsewhere. The first part affected is the tuber; the resting-spore, (oospore,) which has lain dormant nearly the whole year, is ready to mature in June and July, and if it gets sufficient moisture sends out mycelium, which penetrates any tuber it touches, extends up the haulm, and goes to the leaves, there showing its presence by a brown spot. It protrudes through the stomata, forming a grey tint or bloom upon the leaf. This bloom consists of a branched growth upon which are borne two kinds of spores, both of which are capable of growth during the moist summer weather, but neither of which will exist through the winter. One kind of spore we call conidia, or dust spores; these are wafted to another leaf or stem, where they will grow, if they can find a stomate to enter. They will even start into existence on any damp spot, but die quickly unless they can meet with a potato or some closely related species. The other kind of spore is called a zoospore. Its structure is very different; it is capable of division into a number—say eight—of atoms. These have two lash-like tails, with which they can propel themselves for hours or even days together. They are more able to propagate the disease than the others, because of their wonderful power of locomotion; hence a warm wet day or night is very favourable to the spread of the disease.

But the question arises, if these two kinds of spores do their destructive work only in the summer and die, how is the disease propagated through the winter? This is the puzzle which has harassed the minds of the ablest men of the day, and the solution of it has gained for my friend Mr. Worthington G. Smith a gold medal. Mr. Smith collected a great number of the brown-spotted leaves, and kept them moist during the whole of the winter at the cost of a good deal of labour and trouble. The consequence was that these moist leaves produced a quantity of mycelium threads, including the long-looked-for missing link, which is called the resting-spore. If it could be destroyed we should be free from the potato disease. Every diseased potato you leave to be buried in the ground deposits vast numbers of these resting-spores, the haulm you put to the manure heap to rot for future use only increases

the disease. This spore, unlike the others, requires to be fertilised, an office which is performed by a smaller body which grows near it on the mycelium. After their union the oospore is capable of withstanding the cold, and awaits its time to grow; it may, for all we know, live for years, until it finds suitable conditions for growth. As yet there has not appeared anything to destroy it, and certainly the difficulty of its destruction must be enormous. Wet seasons and wet places promote its growth more than dry ones. The same ground should not be used for successive years for the growth of the potato. The haulm and every root and rootlet should be burned. Those varieties of potato which are least affected by the disease, such as the very earliest sorts, should be encouraged, so should the red kinds of winter potato rather than the white. It is not as though the common kind of potato only were attacked. Eleven of the Solanaceæ, the family to which the potato belongs, are recorded as having developed the disease, so has *Arthoceris viscosa*.

In conclusion, let me now give you some idea as to the division of the fungi. The fungi are arranged under two divisions: 1st, the Sporifera, in which the spores are naked; 2nd, the Sporidiifera, in which the spores are in sacs or asci. The first division is subdivided into four families, the second into two. In all these families the name is derived from the predominance of some feature in each.

Hymenomycetes, from Gr. *humēn*, a membrane, and *mukēs*, a mushroom; the fruit being formed on a membrane, which is either naked from the first or soon becomes so, if originally enclosed in a volva.

Gasteromycetes, from *gaster*, a belly, where the fruit is produced in a closed receptacle.

Coniomycetes, from *konis*, dust; the dust-like spores forming the chief character.

Hyphomycetes, from *huphē*, a woven mass of threads.

Physomycetes, from *phusa*, a vesicle or bladder, where the fruit arises from the tip of a thread, penetrating into the vesicle which forms a covering for the fruit.

Ascomycetes, from *ascos*, a sac, where the fruit is formed within asci.

The families are subdivided into thirty-one orders, the orders into 368 genera up to the publication of Dr. Cooke's "Handbook of British Fungi," and the species up to that time (1871) amounted to 2,809. But within the the last few years a great number of species has been recorded as new to Great Britain, and this number does not now represent by hundreds the fungi that are known as British.

In concluding my paper, it must not be thought that I have exhausted the subject. Not a word has been said about the luminosity of fungi, their ubiquity, and the advantage gained in studying them from the fact that they are to be found every day in the year, as compared with flowering plants which can only be obtained during a limited season. Not a word has been said about their geographical distribution, and very little about their hybernation, and their various modes of fructification. These points may be left for a future time.

ARTIFICIAL SEA-WATER.

BY R. M. LLOYD.

Having had occasion to make some artificial sea-water, and not feeling satisfied with Mr. Gosse's formula, I calculated one as below from Dr. Schweitzer's analysis of sea-water at Brighton. I found Mr. Gosse in error with regard to the amount of sulphate of magnesia, his quantities are also very confusing, being partly given in "ounces avoirdupois" and partly in "grains troy." It is, however, unnecessary to be very exact in the respective quantities of the different substances. Plants and animals will thrive in water compounded according to Mr. Gosse's direction. The composition of the sea, moreover, varies not only in different places but in the same place at different times. The most important point, is to have the water of the right specific gravity, which may be told by some form of hydrometer, preferably a hollow glass ball so weighted that it will just float when the water is of the right density.

DR. SCHWEITZER'S ANALYSIS.
Parts in 1,000.

Water	964·74	100 lbs.	=		10 gallons.
Chloride of Sodium	27·06	44·92 oz.	=	44 oz.	15 drs.
Chloride of Potassium	·77	1·28 oz.	=	1 oz.	4 drs.
Chloride of Magnesium	3·67	6·09 oz.	=	6 oz.	2 drs.
Bromide of Magnesium	·03	·05 oz.	=		1 dr.
Sulphate of Magnesia	2·30	3·81 oz.	=	3 oz.	13 drs.
Sulphate of Lime	1·40	2·32 oz.	=	2 oz.	5 drs.
Carbonate of Lime	·03	·05 oz.	=		1 dr.
Iodine and Ammonia	traces				
	1000·				

It is quite unnecessary to use distilled water. Clear stream water, or that from a deep well, is to be preferred. Ordinary pump water must be avoided.

As chloride of sodium (common table salt) usually contains chloride of potassium, it will be sufficient if the weights of the two are added together, and that quantity of common salt used. The salt should be well dried before it is weighed.

Chloride of magnesium must be kept in a closely stoppered bottle until required, as it rapidly absorbs water from the air.

Bromide of magnesium. This being in such a small proportion, may be entirely disregarded if thought well.

Sulphate of magnesia. This, as ordinarily sold under the name of Epsom salts, consists of rather more than half water of crystallisation, (63 parts in 123.) It is, therefore, necessary to make allowance for this, and instead of sulphate of magnesia 3·81 oz. = 3 oz. 13 drams, read Epsom salts 7·82 oz. = 7 oz. 13 drams.

Sulphate of lime is only soluble to the extent of one part in about 400, and, as sea water contains about one part in 700, if a saturated solution of rather more than half the quantity proposed to be made be formed, and then the clear supernatant solution poured off, filtered, if necessary, and added to the other portion, the whole will contain about the proper proportion.

Carbonate of lime. As this occurs in the water proposed to be used, and only in a very small proportion in the sea, it is quite unnecessary to take any further notice of it.

CALENDAR OF NATURE, 1878.

KEPT BY MEMBERS OF THE BURTON-ON-TRENT NATURAL HISTORY SOCIETY.

Explanations: lf., in leaf; fl., in flower.

			Observer.
Jan.		The winter months of 1878 were mostly very wet and mild	C. U. T.
,,	27.—	Heavy fall of snow and rain, causing high flood in the Trent	C. U. T.
,,	31.—	First skating since March 1st, 1877	C. U. T.
Feb.	2.—	Woodbine, lf., Dunstall	W. M. H.
		Small White Butterfly (Pieris rapæ) taken ..	C. F. T.
,,	17.—	Wasp seen at Bretby	S. J.
		Bee seen at Grammar School. A remarkably warm day (therm. 60°.)	C. U. T.
		Bee seen at Walton-upon-Trent.	
,,	23.—	Currant, lf., at Grammar School.	
		Gooseberry, lf., at Grammar School.	
		Thrush's Nest, three eggs, locality Byrkley.. ..	E. B.
,,	24.—	Hybernia leucophearia taken	C. F. T.
,,	25.—	Rhubarb, lf., Grammar School.	C. U. T.
Mar.	3.—	Tortoiseshell Butterfly (Vanessa urticæ) seen ..	C. F. T.
,,	4.—	Hybernia progemmaria and H. rupicapraria taken.	C. F. T.
,,	6.—	Robin's Nest, with five eggs, Stapenhill	F. E.
		Pink Ribes, fl.	
		Tæniocampa instabilis came out of pupa	C. F. T.
,,	9.—	Celandine, fl., locality Tatenhill	G. F. U.
		Coltsfoot, fl., Tatenhill	G. F. U.
		Primrose, fl., ,, ...	G. F. U.
		Violet, fl., ,, ...	G. F. U.
		Wood Anemone, fl., ,, ...	G. F. U.
		Daisy, fl., ,, ...	G. F. U.
		Cuckoo-flower, fl., ,, ...	G. F. U.
		Gorse, fl., ,, ...	G. F. U.
		Thorn, lf., ,, ...	G. F. U.
		Briar, lf., ,, ...	G. F. U.
		Honeysuckle, lf., ,, ...	G. F. U.
		Dog's Mercury, fl., ,, ...	G. F. U.
		Elder, lf., ,, ...	G. F. U.
		Currant, lf., ,, ...	G. F. U.
		Gooseberry, lf., ,, ...	G. F. U.
		Raspberry, lf., ,, ...	G. F. U.
,,	16.—	Ground Ivy, fl., ,, ...	G. F. U.
		Speedwell, fl., ,, ...	G. F. U.
		Wild Strawberry, fl., ,, ...	G. F. U.
		Hazel, fl., ,, ...	G. F. U.
,,	20.—	Palm Willow, fl., ,, ...	G. F. U.
,,	20.—	Thrush's Nest, with young birds, Rangemore ..	J. M.
,,	22.—	Crow's Nest, with eggs, Egginton	H. B.
,,	23.—	Dandelion, fl., Needwood Forest	W. M. H.
		Wood Anemone, fl., Bretby	T. G.
		Cowslip, fl., Bretby	T. G.
		Hedge Sparrow's Nest, three eggs, Branstone ..	F. G.
		Wild Duck's Nest, three eggs, Branstone	F. G.
		Robin's Nest, three eggs, Egginton	H. B.
,,	24.—	The Eurydice gale; thick snow at Burton, 12 30 to 1 30 P.M.	C. U. T.

Mar. 26.—Hard frost (thermometer on grass fell to 12°)	..	C. U. T.
April 10.—Swallows seen, Burton-upon-Trent ..	..	C. F. T.
" 11.—White Butterfly, Branstone ..	..	T. G.
" 14.—Horse Chestnut, lf., Grammar School	..	C. U. T.
Cherry Tree in blossom, Branstone ..	..	F. G.
Forget-me-not, fl., Tatenhill ..	..	F. U.
Bluebells, fl., Tatenhill..	..	G. F. U.
" 22.—Adder's Tongue, fl., Tatenhill ..	..	J. G.
Candock, Stitchwort, Branstone	..	J. G.
Broom, fl., Barton	..	J. G.
May, fl., Catton ..	..	J. G.
" 27.—Water Daisy, near Sinai Park..	..	J. G.
" 29.—Corncrake heard, Yoxall	..	J. G.
" 30.—Chaffinch, three eggs, Branstone	..	J. G.
May 1 & 6. Early growth of vegetation much cut by frost.	..	C. U. T.
" 1.—Horse Chestnut, fl., Manor Croft	..	C. U. T.
" 3.—Wood Pigeon, two eggs, Repton	..	C. F. T.
" 4.—Magpie, six eggs, Bretby	..	S. J.
" 5.—Cuckoo heard, Stapenhill	..	C. A.
" 7.—Hawthorn and Laburnum, fl., the former a scanty blossom generally, owing to wet weather	..	C. U. T.
" 9.—Apple blossom falling ..	..	C. U. T.
10 to 18.—The Trent at times in high flood; rain more or less every day from 6th to 28th.		
" 11.—Dragon Fly, Stapenhill ..	..	J. A.
" 15.—Limes, lf.		
" 17.—Laburnum, lf., Bagot's Park ..	..	C. U. T.
Damson Trees in full bloom, Bagot's Park..	..	C. U. T.
June 2.—Glow Worm, Stapenhill	..	J. C. P.
" 4.—Took S. populi ..	..	C. F. T.
" 5.—Took A. cardamines, M. biriviata	..	C. F. T.
" 6.—Lime, fl. ..	..	C. U. T.
" 7.—Took H. humuli, R. cratægata, I. lactearia, E. alchemillata, E. exiguata, E. vulgata, C. russata	..	C. F. T.
" 8.—Took larvæ of C. spartiata	..	C. F. T.
" 10.—Wild Rose, fl. ..	..	C. U. T.
" 10.—Took H. velleda, E. dolabraria, T. biundularia, E. heparata, A. luteata, C. pusaria, C. corylata, E. castigata, A. betularia, H. grisealis, H. dentina, H. prasinana, C. propugnata, larvæ of D. cœruleocephala, B. quercus, H. defoliaria	..	C. F. T.
" 12 and 13.—Trent in flood.		
" 12.—Took (Swynnerton Woods, Stafford,) F. piniaria, M. liturata, H. crassalis, N. plecta, X. rurea, R. tenebrosa, H. thalassina, E. lucipara	..	C. F. T.
" 13.—Took (Burntwood, Stafford,) L. marginata, M. hastata, L. pectinitaria, C. exanthemaria, P. lacertula, larvæ of T. quercus, B. perfumaria, C. flavicornis ..	..	C. F. T.
" 17.—Took (Eyam, N. Derbyshire) A. ulmata	..	C. F. T.
" 18.— " " " F. atomaria, E. albulata ..	..	C. F. T.
" 19.—Took (Miller's Dale) A. menthastri, A. fuliginosa, M. montanata	..	C. F. T.
" 21.—Took (Burton) A. psi ..	..	C. F. T.
" 23 to 28.—Very hot weather: on 26th thermo. 90° at Burton, 95° at Nottingham; on 26th, ·24 inch of rain fell in fifteen minutes during a thunderstorm		

June 25.—Took A. incanaria, M. brassicæ .. .. .. C. F. T.
„ 27.—Took S. janira, M. albicillata, L. didymata, A. nebulosa, P. gamma, S. olivalis .. .. .. C. F. T.
„ 28.—Took T. amataria, C. bilineata, P. chrysitis, M. strigilis, H. proboscidalis .. .. .. C. F. T.
July 1.—Took H. oleracea, A. triplasia, A. putris, A. exclamationis, M. typica .. .. C. F. T.
„ 3.—Took (Eyam) B. repandata, E. palumbaria.. .. C. F. T.
„ 4.—Took H. pamphilus, Z. filipendulæ, T. chærophyllata .. .. C. F. T.
„ 6.—Took L. cæsiata, A. rumicis, M. fasciuncula, A. myrtilli .. .. C. F. T.
„ 8.—Took E. nanata, P. forficalis .. .. C. F. T.
„ 9.—Took (Eyam) L. Alexis, N. mundana .. .. C. F. T.
„ 12.—Took H. lupulinus, A. fumata, A. aversata, C. fulvata .. .. C. F. T.
„ 17.—Took (Burton) E. rectangulata, E. sambucalis .. C. F. T.
„ 18.—Limes' leaves falling .. .. C. U. T.
„ 19 & 21.—Therm. 90° in shade, 150° in sun .. .. C. U. T.
„ 19.—Took O. potatoria, P. syringaria, Y. elutata, E. mensuraria, L. impura, P. iota, B. urticalis .. C. F. T.
„ 22.—High wind from N.E., blowing down branches, &c., from trees.
Aug. 3 to 18.—Rain more or less every day, except one .. C. U. T.
„ 16.—Took H. wavaria, T. orbona, larvæ of A. psi, and P. bucephala .. .. C. F. T.
„ 17.—Took larvæ of S. populi, H. oleracea, and D. vinula C. F. T.
„ 24.—Took pupæ of N. typhæ .. .. C. F. T.
„ 29.—Took A. niveus .. .. C. F. T.
Sept. The autumnal tints appeared unusually early.
„ 3.—Took C. testata .. .. C. F. T.
„ 19.—Took C. spartiata .. .. C. F. T.
24 to 26.—Three frosty nights brought on rapidly the fall of leaves, especially from limes and chestnuts .. C. U. T.
„ 24.—Took (Swinnerton) A. rufina, A. saucia, X. ferruginea, P. meticulosa .. .. C. F. T.
„ 26.—Took larvæ of F. piniaria, E. nanata, E. minutata, A. porphyrea, A. myrtilli, imago of T. variata .. C. F. T.
Oct. 5.—Very fine warm day, therm. 73° in shade .. .. C. U. T.
„ 14.—Took O. dilutata .. .. C. F. T.
„ 27.—Deep and early snow in the Peak of Derbyshire .. C. U. T.
„ 30.—Snow at Burton .. .. C. U. T.
Nov. Frequent falls of snow characterised this month.
11 to 13 } Trent in flood.
16 to 18 }
25 & 30.—Dense fogs.
„ 26.—H. aurantiaria emerged from pupa .. .. .. C. F. T.
Dec. Frost occurred every night till the 30th. Skating began about the 6th. Trent at Drakelow bore skating on 14th, and on the 23rd at the Recreation Ground. A rapid thaw occurred on the 30th and 31st.. .. .. C. U. T.
„ 17.—H. defoliaria emerged from pupa .. .. .. C. F. T.

[We are indebted to the courtesy of the Burton-on-Trent Natural History and Archæological Society for permission to insert the foregoing interesting calendar.—Eds. M.N.]

Reviews.

The Study of Rocks. By FRANK RUTLEY, F.G.S. London: Longmans, Green, and Co.

This is a new volume of Messrs. Longmans' well-known cheap series of "Text-Books of Science." Mr. Rutley is petrologist to the Government Geological Survey, and in the book now before us he supplies a want much felt by English geologists, viz., a thorough and correct introduction to the study of rocks. To be able to recognise and correctly describe rocks, at all events any which we shall be likely to meet with in this country, is a power which must be diligently sought after by every student of geology. Such a knowledge, we have no hesitation in saying, can neither be aquired from books alone nor from specimens alone, but any one who will combine the two, who will carefully study Mr. Rutley's work, while at the same time he examines collections of rocks and minerals, such as may be seen in any public museum, or obtained by exchange, or purchased from dealers, cannot fail to lay the foundation of a sound practical knowledge of this subject, which will be of great value to him at every succeeding step in the science of geology. In the introductory chapters of this book Mr. Rutley gives, in a clear and concise manner, an account of the structure and phenomena of rock masses. He then gives very valuable and practical information on the formation of a rock collection, and on the examination of rocks, especially by the aid of the microscope. This part concludes with an account of the principal rock-forming minerals, their megascopic and microscopic characters.

In Part II. the author describes the several species of rocks under two main heads—Eruptive and Sedimentary. This portion of the work is especially interesting, as it contains the latest, and, indeed, new, information on many points of interest and importance. This portion of the book would bear much amplification, so that in future editions (which will certainly be called for) the descriptive petrology might well form a second volume. Altogether, it is certain that all practical workers in geology will hail as a great boon the appearance of this book, for it fills a distinct gap in the (English) literature of the science, whilst we may further hope that it will promote clearness of ideas and uniformity of nomenclature.

W. J. H.

The Post-Tertiary Deposits of Cambridgeshire. By A. J. JUKES-BROWNE, B.A., F.G.S. Cambridge: Deighton, Bell, and Co.

THIS work is the Sedgwick Prize Essay for 1876. It constitutes an interesting and important contribution to the study of one of the "burning" geological questions of the day—the origin, nature, and classification of the deposits of the Glacial Period. In the first two chapters Mr. Jukes-Browne furnishes a history of the work already done in this direction, both generally (chap. I.) and in the county of Cambridge, (chap. II.) He next briefly denotes the physical features of the county, and then enters more fully into an account of the *Great Chalky Boulder*

Clay, which he believes to be the lowest glacial deposit present. The gravels and sands which occur sometimes in, sometimes below this great clayey deposit, he regards as local only, and not forming part of the *Middle Glacial Sands* of Mr. Searles V. Wood, jun. As to the mode of its formation, Mr. Jukes-Browne considers that the Chalky Boulder Clay was formed by matter dropped from bergs and coast-ice in a sea open to the north, but with land to the south and west. When this area was again elevated, the coarse hill gravels (with what are called the "Plateaux" and "Flood" gravels) were formed on the highest points as they rose above the sea by the action of currents on the boulder clay. The elevation increasing, rivers would begin to flow over the new land surface, and from their action the several series of river gravels would result. Altogether this essay is a valuable contribution to the geology of the district to which it relates. The author is upon the staff of the Geological Survey, and we shall look forward with interest to further accounts from his pen describing in other districts the deposits of which he has given us so good an account in Cambridgeshire.

W. J. H.

Proceedings of the Chester Society of Natural Science. No. II. Chester: Printed for the Society. Price 2s. 6d.

THIS Society is evidently doing good work, and the pamphlet which has just been issued does the members very great credit. It contains a number of thoughtfully and ably written papers on the geology and the fauna and flora of the Chester district, and is illustrated by an autographic print, taken from a photograph, of a specimen of Stigmaria, from the coal measures of Trefnant, near Ruabon. Mr. A. O. Walker, F.L.S., contributes two very interesting papers, viz., "Observations on Phenomena connected with the Deposition of Sediment at the present day in the Estuary of the Dee, and their bearing upon Older Deposits;" and "Notes on the Lower Coal Measures between Bagillt and Holywell." Mr. George W. Shrubsole, F.G.S., contributes a paper "On the Origin of Rock Salt," in which he contends that "rock salt has been derived from the evaporation of water." Mr. W. Shone, F.G.S., supplies a valuable paper on "The Drift Deposits of West Cheshire," with the lists of the foraminifera, ostracoda, mollusca, polyzoa, cirripedia, annelida, echinoidea, and spongida, found by himself and other members of this society. Dr. H. Stolterfoth, M.A., contributes an excellent "List of the Diatomaceæ found in Chester and district and Cwm Bychan, N.W." In this list are some very rare species. There is a very able paper by Mr. J. D. Siddall "On the Foraminifera of the River Dee," giving descriptions of several species new to the British fauna which have been found in this river; together with extensive lists of the species found by him, many of them very rare. Mr. T. Shepheard gives an excellent account of the "Freshwater Polyzoa found in the neighbourhood of Chester," with descriptions and notes. There is also a lengthy communication by Mr. J. Price, M.A., on "Proliferous Leaves and Notes thereon," being an account of some original investigations made by him on *Cardamine pratensis*. Mr. Price finds that every leaflet of this plant will germinate and give origin to a new plant. This paper is worthy of the attention of all botanists. Mr. E. J. Baillie contributes "The City Flora," and gives a list of over 400 flowering plants and ferns found within the "city of the county of Chester." These proceedings are well printed, and free from typographical errors.

J. E. B.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF APRIL, 1879.

BY W. JEROME HARRISON, F.G.S.

STATION.	OBSERVER.	RAINFALL. Total for M. In.	Greatest fall in 24 hours. In.	Date.	No. of rainy d.	TEMPERATURE. Greatest ht. Deg	Date.	Great'st cold. Deg	Date.
GLOUCESTERSHIRE.									
Cainscross, Stroud	W. B. Baker, Esq.	2·55	·72	20	6	65·0	3	26·0	2
Cheltenham	R. Tyrer, Esq.	2·59	·58	6	20	56·2	27	26·5	4
Stroud	T. J. Coley, Esq	2·36	·59	7	15	59·0	23	29·0	13
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	2·49	·40	9	17	56·0	26	23·0	13
Woolstaston	Rev. E. D. Carr	2·82	·43	9	21	63·0	3	20·0	13
Leaton Vicarage, Shrewsbury	Rev. E. V. Pigott	3·01	·61	9	25	56·9	4	19·1	13
More Rectory, Bishop's Castle	Rev. A. Male	2·25	·35	26	24	57·0	26	25·0	13
Larden Hall, Much Wenlock	Miss F. R. Boughton	2·80	·57	9	21				
Bishop's Castle	E. Griffiths, Esq.	2·16	·29	26	21	58·0	4	23·0	13
Cardington	Rev. Wm. Elliott	3·37	·61	9	20				
Stokesay	Rev. J. D. La Touche	2·29	·26	20	21	59·3	27	23·6	13
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	2·41	·45	6	20			24·0	13
Stoke Bliss	Rev. G. E. Alexander	2·78	·28	11	20	57·0	27	26·0	12
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq	2·96	·40	6	20	57·8	27	23·8	13
West Malvern	A. H. Hartland, Esq.	2·95	·44	6	17	55·0	4	24·5	12
Pedmore	E. B. Marten, Esq.	2·54	·34	6	23	60·0	27	28·0	12
Longlands, Stourbridge	J. Jeffries Esq.	2·37	·32	6	21	62·0	26	28·0	3 & 21
Dennis, Stourbridge	Mr. C. Webb	2·40	·28	6	21	57·0	4	27·0	12
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	2·84	·42	23	20				
Dudley	Mr. J. Fisher	2·66	s)·40	30	19	62·0	26	28·0	12
Sedgley	Mr. C. Beale	2·84	·35	6	17	54·0	26 & 27	28·0	12
Kinver	Rev. W. H. Bolton	2·32	·33	26	19	57·0	26	26·0	12
Walsall	Mr. N. E. Best	3·10	·56	23	20	54·0	7 & 26	27·0	12
Grammar School, Burton	C. U. Tripp, Esq.	2·68	·49	9	18	58·0	2, 27, 29	25·0	22
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	2·91	·55	23	18	59·0	27	18·0	24
Wrottesley	E. Simpson, Esq.	3·37	·67	26	18	55·0	5, 27, 28	24·1	13
Heath House, Cheadle	J. C. Philips, Esq	2·86	·76	23	16	56·0	7	25·0	13
Alstonfield Vicarage	Rev. W. H. Purchas	3·01	·63	23	16	56·5	10	22·4	14
WARWICKSHIRE.									
Coventry	J. Gulson, Esq.	2·67	·46	6	16	60·0	26		
Coundon, Coventry	Lieut.-Col. R. Caldicott	2·87	·49	6	18	58·0	26	29·0	12 & 13
Bickenhill Vicarage	J. Ward, Esq.	2·98	·53	19	14	47·0		31·0	
Oscott College	Rev. S. J Whitty	2·78	·61	23	18	56·9	26	26·5	13
Henley-in-Arden	T. H. G. Newton, Esq.	3·09	·54	23	17	59·0	27	27·0	13
Rugby School	Rev. T. N. Hutchinson	2·15	·44	23	18	59·0	26	27·4	23
DERBYSHIRE.									
Buxton	E. J. Sykes, Esq.	3·27	·42	20	19	53·2	26	19·9	13
Stoney Middleton	Rev. U. Smith	3·30	·58	23	15	54·0	8, 25, 26	12·0	12
Brampton S. Thomas	Rev. J. M. Mello	2·73	1·00	10	9	61·0	21	22·0	13
Fernslope, Belper	J. G. Jackson, Esq.	2·60	·48	9	13	57·0	26	26·0	13
Linacre Reservoir	C. E. Jones, Esq.	3·07	·51	9	17				
Spondon	J. T. Barber, Esq.	2·67	·54	9	17	57·0	26	25·7	3
NOTTINGHAMSHIRE.									
Tuxford	J. N. Dufty, Esq.	2·50				60·0	29	25·0	12
Hodsock Priory, Worksop	H. Mellish, Esq.	2·67	·54	9	19	60·0	26	23·6	13
Park Hill, Nottingham	H. F. Johnson, Esq.	3·07	·75	9	14	57·5	7	30·3	12
Hesley Hall	B. J. Whitaker, Esq.	2·51	·43	10	14	63·0	27	29·0	12
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	2·46	·46	9	15	58·3	7	27·7	22
Ashby Magna	Rev. E. Willes	2·41	·61	23	18	61·0	26	24·0	12, 19, 22
Market Harborough	S. W. Cox, Esq.	2·20	·45	12	15	58·0	26	23·0	12
Kibworth	T Macaulay, Esq.	2·35	s)·44	12	17				
Town Museum, Leicester	W. J. Harrison, Esq.	2·11	s(·49	14	18	57·9	26	28·5	22
Belmont Villas, Leicester	H. Billson, Esq.	2·18	·38	9	18	61·6	7	29·0	12 & 22
Syston	J. Hames, jun., Esq.	1·62	·33	14	15	60·0	5 & 8	28·0	12 & 13
Waltham-le-Wold	E. Ball, Esq.	3·16	·44	9	15	58·0	26	27·0	11
Little Dalby Hall	G. Jones, Esq.	2·63	·36	7	14	60·0	26	23·0	12 & 22
Foxton Locks	Union Canal Company	1·88	·35	15	13				
Coston Rectory, Melton	Rev. A. M. Rendell	2·66	·51	23	18	58·5	7	21·0	22
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	2·18	·63	12	13				
Castle Ashby	R. G. Scriven, Esq.	2·78	·59	23	16	61·0	26	28·0	11
Kettering	J. Wallis, Esq.	3·34	·70	23	17	59·0	27 & 28	28·0	13
Althorpe	C. S. Groom, Esq.	1·84	·41	6	13	59·0	26	26·0	11 & 17
Pitsford	C. A. Markham, Esq.	2·07	·58	12	17	62·0	27	26·0	12
RUTLAND.									
West Deyne, Uppingham	Rev. G. H. Mullins	3·08	·60	23	16	57·2	26	26·9	12
Northfields, Stamford	W. Hayes, Esq.	2·54	·45	9	14	60·0	27	25·0	12
Ventnor Hospital	W. T. Ryder, Esq.	3·63	1·20	15	6	57·8	27	28·7	12
Altarnun Vicarage	Rev. G. Tripp	3·27	·60	20 & 24	19	62·0	21	22·0	12

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The first few days of the month were fairly warm and fine, but the weather soon relapsed into the cold, sunless, showery character which has characterised the long and dreary winter, which, even now, (May 23rd,) can scarcely be said to have passed away. From the 11th to the 15th snow fell more or less at every station. The fall of the 12th was heavy, and on Easter Sunday (13th) from five to eight inches of snow covered the ground. Easterly winds continued to prevail, and, with almost nightly frosts, so checked vegetation generally that the hedges were black and bare up to the last day. The temperature may be estimated at five or six degrees below the average; rainfall about the average. From the 27th to the 30th thunderstorms were experienced with hail. The Rev. J. Brooke (Shifnal) writes:—"The coldest Easter-day for at least forty-five years, the min. temperature being 23°, and the max. 40°; the next nearest being 1836, (April 3rd,) when min. was 32° and max. 44." Mr. T. H. Davis, (Orleton)—"The coldest month of April that has occurred for more than twenty-four years." We are indebted to our meteorological observers for the accompanying notes of spring birds and flowers.

Dates of Spring Flowers.—*Brampton S. Thomas*—Anemone nemorosa, Mercurialis perennis, fl., 11th; Elder, Hawthorn, l., 29th; Ranunculus Ficaria, fl., 30th. *Stroud*—Fl. on 1st, Wood Sorrel; 5th, Goat Willow (stamens;) 8th, Caltha palustris; 9th, Periwinkle, Wood Anemone, Daffodil; 10th, Red Dead Nettle; 14th, Cinquefoil; 25th, White Dead Nettle, Ground Ivy; 29th, Fragaria vesca, Cowslip, Ranunculus aquatilis, Wood Spurge; 30th, Æthusa cynapium, Cardamine pratensis, Adoxa moschatellina, Chrysosplenium alternifolium.

Migratory Birds, &c., heard or seen.—*Castle Ashby*—Swallows, a few on 20th, main body on 26th; Cuckoo heard on 28th; Nightingale, May 7th. *Woolstaston*—Swallow, 21st; Cuckoo, 23rd. *Coston Rectory*—Cuckoo, 22nd. *Shifnal*—Swallow, 23rd; Cuckoo, 22nd; Sand Martin, 14th; White Butterfly, 29th; Yellow-tip Humble Bee, 4th. *Market Harborough*—Swallow, 19th; Cuckoo, 21st. *Weston-under-Lyziard*—Swallow, 25th. *Bishop's Castle*—Swallow, 24th; Cuckoo, 21st. *More Rectory*—Swallow, 19th; Cuckoo, 21st; Redstart and Garden Warbler, 22nd. *Cheltenham*—Swallow, 20th; Cuckoo, 27th. *Much Wenlock*—(One) Swallow, 25th; Cuckoo, 23rd. *Tenbury*—Swallow, 17th; Cuckoo, 20th; Chiff-chaff seen on 1st. *Handsworth Wood*—Cuckoo, 25th.

Correspondence.

Chrysosplenium alternifolium.—This plant, stated in most works on Botany to be "rare," or "not common," I have found in several parts of this neighbourhood. Will any of the readers of the "Naturalist," who have seen it elsewhere, tell me where it is to be found?—Observer, Stroud.

Two Precambrian Groups in Shropshire.—I have recently obtained clear evidence of a second Precambrian formation, near Wellington. In Primrose Hill, the south-westerly spur of the Wrekin, I have come upon an exposure of hornblendic gneiss, with a high dip to the N.E. Associated with this bedded rock are a red granitoidite and a well-crystallised diorite. The identity of these rocks with some of the common Malvern types in my cabinet is undoubted, and the strike precisely corresponds with that of the Malvernian series. This metamorphic group is unconformably overlaid by the tuffs and rhyolites of the Wrekin. I have just returned from a visit to St. David's, where I

was struck with the close resemblance between the lower part of the Pebidian and the ashy slates and hälleflintas of Lilleshall Hill. These Lilleshall rocks I have also detected on the flanks of the Malvern Hills. Thus light begins to dawn upon the obscurity which has hitherto enveloped these ancient and difficult rocks. This is the first announcement of the discovery of a second series in Salop, but I must not do more than state the bare fact at present.—C. CALLAWAY.

BLACK BAND IN THE DRIFT.—I hope Mr. Atkins will examine carefully the black band referred to in last month's notes. A similar band was described by the late Dr. Ick, Curator of the Birmingham Philosophical Institution, as occurring at Saltley. Several horns were found in the deposit, and also nuts of the common hazel. It would seem likely that organic remains should be found in the bed Mr. Atkins describes.—C. J. WOODWARD.

NOTES ON ORNITHOLOGY.—Whatever may be the effect of severe weather upon the arrival of our Spring migrants on our shores, it certainly causes them to put in an appearance in the Midland Counties at a later date than usual. Thus, nearly all the dates below mentioned are later, and some of them markedly so than in former years. The Chiffchaff and Blackcap, mentioned in my last notes, were observed later than for three years. The Sand Martin's arrival is the latest record I have by nine days. The Swallow, House Martin, Willow Wren, and Cuckoo were all late, whilst the Nightingale has been heard on an earlier date for seven consecutive years past. At the time I write (May 12th) the Swifts have not yet arrived. I have thirteen arrivals to chronicle, viz. :—

April 11.—Lesser Whitethroat *(Sylvia curruca.)*
„ 17.—Swallow *(Hirundo rustica.)*
„ 21.—Willow Wren *(Sylvia trochilus.)*
„ 25.—Sand Martin *(Hirundo riparia.)*
„ 25.—Nightingale *(Philomela Luscinia.)*
„ 26.—House Martin *(Hirundo urbica.)*
„ 29.—Common Whitethroat *(Sylvia cinerea.)*
„ 30.—Tree Pipit *(Anthus arboreus.)*
„ 30.—Cuckoo *(Cuculus canorus.)*
May 1.—Garden Warbler *(Sylvia hortensis.)*
„ 4.—Wood Wren *(Sylvia sibilatrix.)*
„ 6.—Grasshopper Warbler *(Avicula locustella.)*
„ 8.—Sedge Warbler *(Salicaria Phragmitis.)*

Several others are overdue, and are probably here, but I have failed to observe them. Two small flocks of Fieldfares were seen passing on April 12th, others on 19th, and the last party on 22nd. A nest of Blackbirds was hatched off on April 15th, but the young brood succumbed to the severity of the weather. Rooks were hatched on April 20th. A friend writes me that she heard the Nightingale in Derbyshire on April 17th. In the last number of the "Midland Naturalist," a correspondent in North Notts notes the advent of a doubtful migrant, either *Sylvia rufa* or *S. trochilus*. From the date given, April 5th, it was probably the former, but, as the birds themselves are so easily distinguished, and their notes are so different, there ought to be no doubt as to which it was. I shall be very glad to compare my dates with those of any other observers in the county of Leicester if they will correspond with me.—THOMAS MACAULAY, M.R.C.S.L., &c., Kibworth.

ORNITHOLOGICAL NOTES FROM DERBY.—A birdstuffer here, a short time since, showed me a Dipper, *(Cinclus aquaticus,)* which he said had been shot in Christmas week, on a small brook near the Workhouse. That interesting pile is just on the outskirts of the town, and the brook is a small stream running through the red marl, and averaging in width

about a yard. The Dipper is common on two of our Peak rivers, the Wye and the Dove, and I have very little doubt on the Derwent also, though I cannot call to mind that I have ever noticed it there. But the place it frequents nearest to the brook above-mentioned is at least fifteen miles away, and the occurrence of a species, like the Dipper, loving rocky limestone streams, on a little lowland clay brook, quite close to a large town, is, I think, remarkable.—The same birdstuffer said he had not had a single Brambling brought to him during the past winter. Usually he has them in abundance.—I have heard of two more Hawfinches being killed near Derby lately, at Mickleover and Quarndon. In my note on the Hawfinch, p. 123, line 21, for "light" read "bright."—Merlin, Derby, 18th May, 1879.

Ornithological Notes.—A few swallows were seen here early. Mr. Bill and Mr. Kirby both saw one on the 8th April, and the Cuckoo was heard at Keresley on the 16th. Mr. Miller, of Combe Gardens, writes me that he saw the first pair of swallows there on the 20th, and on the 25th these birds seemed to have settled down to their work. The Nightingale was heard in High Wood on the 22nd. Mr. Miller writes:—"The late season has made no difference to the rooks, for they commenced the repair and re-building of their nests punctual to a day—in the first week of March. I have ample opportunity of observing them. In a tree within gunshot of my sitting-room window are about twenty-five nests. In this tree, which is a large oak covered with ivy to within three feet of the highest branches, there are breeding at the same time the rook, the ringdove, the stock pigeon, the starling, the sparrow, and, for aught I know, the blackbird and thrush. Later in the season the turtle dove is not an unusual frequenter of this tree. Besides this being my natural history tree I also call it my weathercock, for, as we have east wind prevailing more or less throughout spring, during the time the east wind is blowing the rooks sit on the branches with beaks eastward, tails westward. You can understand it to be a great pleasure, after a long tack of east wind, to come down one fine morning and find the rooks all sitting with beaks westward and tails to the east." Of the summer migrants the chiff-chaff, willow wren, and wryneck seem to be about in their usual number, but I have seen and heard very few of the other small songsters. The blackcap, garden warbler, whitethroat, redstart, and others are all due about the middle of April; but whether their numbers have been thinned by cold in their southern climate, or whether they are late in their arrival, there is certainly an unusual deficiency in the number of these little visitors at present.—John Gulson, Coventry.

Ornithological Notes.—With regard to the Wryneck mentioned in my notes in March, and in the last number of the "Midland Naturalist," I did not see the bird, but only heard it. I heard it again on the 19th March, near the same place, and was quite convinced that it was of that species. I much regret not having gone to the place, so as to have made it a certainty. "Merlin," in the last number, wishes to know if the increase of Hawfinches has been observed elsewhere. For some years I only heard of one specimen having been killed just here, but this season five have been observed; three of them were shot (one being a bird of the year,) the other two, a pair, frequented our garden for some months, and during the frost fed with the other birds. They were last seen about the end of February. A Coot was shot here on March 14th. It is almost a rarity in this district; the absence of large pieces of water may account for this. I saw two Water Rails is different places during that month; this bird seems to have become more common lately. Early in April Chiffchaffs and Willow Wrens arrived, notwithstanding the wintry weather, which, however, does not seen to have affected our migrants in as great a degree as might have been expected. On the 3rd April a pair of Lesser Spotted Woodpeckers were observed on some

poplars in this village; although rare, a few of these birds are seen every year. The last large flock of Fieldfares I saw was on April 5th. On the 16th of that month I heard young Rooks calling from the nests. I was rather surprised to hear them so early, as the old birds were rather behind hand in beginning nesting operations. The first Swallow I saw was on the 19th April; they were not, however, plentiful till the 27th. House Martins were not here till the 26th, a very late date. The Cuckoo was first seen on the 27th; but was heard on the 20th. On that day I observed several small birds feeding on the tops of some fir trees, which on examination turned out to be Siskins. This seems late for them to be here. I counted eight. A flock of yellow Wagtails, about twenty, was seen on a fallow on the 21st, strange to say in company with one grey and a pair of the pied species. On the 4th May I put up a Mallard and Duck from off the Cherwell, where they are no doubt going to nest. A Swift was seen on the 10th of that month, and on the same day I saw two male Redstarts.—O. V. Aplin, Bodicote, Oxon, May 14th, 1879.

Seasonable Observations.—I heard the welcome note of the Cuckoo *(Cuculus canorus)* for the first time on April 24th, 1879, April 17th, 1878, April 22nd, 1877. Swallows *(Hirundo rustica)* first seen April 22nd, 1879, April 17th, 1878, April 27th, 1877. Window Martins *(Hirundo urbica)* first seen April 26th, 1879, April 23rd, 1878, April 28th, 1877. Nightingale in full song April 25th, 1878, and May 6th, 1879. I have observed *Potentilla fragariastrum* in flower April 24th. *Primula veris*, *Taraxacum dens-leonis*, and *Cardamine pratensis* April 25th. Wild Cherry *(Prunus avium)* in sheltered places April 27th, not observed in more exposed places till May 6th. *Prunus spinosa* by April 30th. *Saxifraga tridactylites* by May 3rd. *Lamium album* and *Geranium rotundifolium* by May 5th. The Wild Bullace and Wild Plum were in flower in the hedges May 6th. *Anthriscus sylvestris* in flower May 11th; *Cerastium glomeratum*, Ribwort Plantain, *(Plantago lanceolata,)* Beech, *(Fagus sylvatica,)* and *Sisymbrium alliaria* on May 13th; and Wild Pear *(Pyrus communis)* on May 14th. Brimstone Butterfly first seen March 19th, Tortoiseshell Butterfly March 28th, Red Admiral and Peacock Butterflies seen on April 8th, White Cabbage Butterfly first seen May 4th. Wood Crowfoot *(Ranunculus auricomus)* in flower by May 4th.—Robert Rogers, Castle Ashby, Northampton.

Gleanings.

Midland Union.—The Annual Meeting next year will be held at Northampton, on the invitation of the Northampton Natural History Society, the President of which is the President-elect of the Union.

Deep Borings.—In Hertfordshire the Colne Waterworks Company have long been engaged in putting down a deep bore-hole to obtain an additional supply of water. We understand that at a depth of about 1,000ft. they have struck Silurian rocks. The bores being of great diameter have yielded numerous fossils of Wenlock species.

Mock Sun.—On April 19th, whilst in the train from Ashbourne to Rocester, I saw, between 6 15 and 6 40 p.m., a brilliant example of mock-sun, varying in colour from white to yellow-and-red. It was near the horizon, about 20 degrees from the setting sun.—C. U. Tripp, Burton-on-Trent.

Snow in May.—A correspondent in the *Times* says there is yet (May 21st) enough snow on Snowdon to enable mountaineers to enjoy their favourite occupation within a few hours of London. The gullies which descend from the peak towards Glaslyn are still full of snow. This he adds is most unusual at this time of the year.

FRESHWATER LIFE.—Mr. Bolton, 17, Ann Street, Birmingham, informs us that, in continuation of his report (pp. 97 and 127) he has sent the following additional objects to his subscribers:—Young *Cristatella mucedo*, just developed from the statoblast; *Synchæta mordax;* Embryo of freshwater Mussel, *Anodonta cygnæa; Nitella translucens*, with *Carchesium polypinum; Batrachospermum moniliforme;* Elver, or young Eel; Spawn of Perch; *Melicerta ringens; Melicerta tubicolaria* (or *tyro;) Pandorina morum; Volvox globator;* and *Fredericella sultana.* These were, as usual, all illustrated by drawings from under the microscope by Mr. H. E. Forrest, or by copies of Dr. Hudson's, Professor Allman's, Oersted's, or other drawings, with appropriate descriptions. It is interesting to know that Mr. Bolton has found a new habitat for the rare rotifer, *Melicerta tubicolaria*, (or *tyro*,) of which Dr. Hudson gave a most interesting account and drawings in the "Monthly Microscopical Journal," November, 1875, (vol. xiv., p. 225.)

HARDY SPRING FLOWERS of the undermentioned kinds were exhibited in bunches, by Mr. W. Ingram, of Belvoir Castle, at the Conversazione at Leicester, on the 20th of May, on the occasion of the visit of the Midland Union. They were in superb condition, and showed what glorious decorative resources for our gardens we have in plants which are sufficiently hardy to withstand the severity of such a winter and spring as we have just passed through. We urge our horticultural readers to make a note of this list, and select from it for the enrichment of their gardens for next and future years. All the plants should be planted in the Autumn. Arabis albida, Alyssum saxatile compactum, Alpine auricula, Anemone apennina, A. fulgens, A. nemorosa plena, A. Robinsoniana, Cowslips and Oxlips in variety, Corydalis nobilis, Doronicum austriacum, Epimedium macranthum, E. sulphureum, Gentiana acaulis, Iris pumila, I. pumila cerulea, I. pumila bicolor (Ingram), Lamium maculatum, Leucojum æstivum, Lonicera fragrantissima, Lunaria biennis white and red, Muscari botryoides, Myosotis dissitiflora, Narcissus maximus, N. poeticus tripedalis and other varieties, Omphalodes verna, Orobus vernus, Primula acaulis, many excellent varieties obtained by cultivation, P. cortusoides amœna, Phlox verna, P. subulata, Pulmonaria azurea, Saxifraga cordifolia, S. crassifolia, Scilla amœna, Triteleia uniflora lilacina, Uvularia grandiflora. No one who saw these lovely flowers will ever forget how beautiful they were.

PARASITES—A new work by Dr. Spencer Cobbold, F.R.S., is announced, (publishers, Messrs. Churchill,) in which the author treats of the subject of parasites as it affects the whole animal kingdom. The *Athenæum* says the volume is divided into two books, the first dealing with the parasites of man, and the second with those of animals, including birds, reptiles, fishes, &c. Great attention has been given to the department of epidemics, (epizoöty,) both as regards public health and the welfare of our domesticated animals.

GEOLOGY AT THE CRYSTAL PALACE.—Do many of the visitors seek out the interesting illustrations of geological facts which are to be seen in the Palace and its grounds? Inside the building there is a good exhibition of flint implements, of specimens of fuel peat, lignite, all the varieties of coal, &c., and also sections showing the structure of the London Tertiary Basin. In the grounds there is, near the lake, the representation of a coalfield, the rocks, limestones, sandstones, grits, clays, and shales having been brought from the Yorkshire and Derbyshire coalfield. Mineral veins and caverns are seen, faults may be noted; Permian and Devonian beds are shown above and below. On the shores and islands of the lake are full-size restorations of various extinct animals, as the Labyrinthodon, Ichthyosaurus, Iguanodon, Palæotherium, &c. These were executed under the direction of Mr. Waterhouse Hawkins and Professor Owen.

THE AGE OF THE EARTH.—Mr. A. J. Richardson recently read a paper on this subject before the members of the Northampton Natural History Society, in which he dealt with the various theories which have been propounded, giving in detail the geological, biological, and physical estimates of the antiquity of the earth, and the methods by which the calculations were made. The discrepancies were stated as very wide, the physicists arguing that from sixty to eighty millions of years was the most that could be deduced from physical reasoning, whilst the biologists were of opinion that not less than 200 millions were sufficient to account for the vast quantity of species present on the globe, the geologists, however, being satisfied with an intermediate demand of somewhere about 120 millions. The theories of Croll's glacial epochs and many other very interesting points were fully explained, and in such a manner as to keep the attention of the meeting with the lecturer through the hard facts and mathematical formula which necessarily had to be quoted.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—GEOLOGICAL SECTION.—April 22nd. Mr. C. T. Parsons sent a curious monstrosity in the flower of a fuchsia.—Mr. H. E. Forrest exhibited *Cladophora ægagropila*, a remarkable alga, which grows in large balls at the bottom of a few English lakes. It is supposed to acquire its globular form from being rolled about by currents at the bottom of the lake.—Mr. J. H. Lloyd gave an account of the rocks of the Lizard district, illustrated by a map and a large number of specimens.—Mr. S. Allport shewed some sections of the same rocks. GENERAL MEETING.—April 29th. Mr. Thos. Bolton exhibited in the microscope an elver, or young eel, shewing the whole internal organisation with great clearness.—Mr. T. Roberts exhibited spawn of the toad.—Mr. J. Levick exhibited a double flower of the garden anemone, and in the microscope—tadpole of frog, showing the circulation of the blood in the gills, and the action of the cilia which clothe them externally on the surrounding water.—Mr. J. E. Bagnall exhibited valves of *Pellia epiphylla*, and endothecium of crocus, to shew the fibro-cellular tissue; *Mnium subglobosum*, a moss from near Shirley; and *Cardamine pratensis* shewing prolification of the leaves, sent by Mr. J. Price, M.A., of Chester. May 6th.—GENERAL MEETING.—Mr. R. M. Lloyd exhibited *Succinea virescens*, a very rare mollusc, found by himself at Acocks Green.—Mr. T. Bolton exhibited spawn of Perch, (?,) showing curious radial striæ in the albumen.—Mr. J. E. Bagnall exhibited *Peziza trechispora*, a micro-fungus, from canal bank, Wilnecote, and *Viola hirta*, from Wooton Wawen.—Mr. W. H. Wilkinson exhibited a number of mosses from the Malvern Hills, comprising, among others, male and female plants of *Polytrichum piliferum* and *juniperinum;* also *Marchantia conica*.—Mr. H. E. Forrest exhibited and read some notes upon a living specimen of *Hydractinia echinata*, which had lived in a small marine aquarium, belonging to Mr. A. E. Bayliss, for six weeks. He described the alimentary, male, and female polypites, and the two kinds of defensive zooids, and pointed out the remarkable specialisation exhibited by them, no one polypite fulfilling two functions. He also called attention to the curious relationship existing between the Hydractinia and the Hermit Crab, the two being always found in company. This specimen was an example of a *triple* comensalism, the shell being occupied not only by the crab and the hydrozoon, but also by a species of Nereis. Mr. W. R. Hughes said that the bond which united them was probably one of mutual advantage, since both the Hydractinia and the Nereis would profit by the crumbs dropped by the hermit crab.—BIOLOGICAL SECTION.—May 13th. Mr. T. Bolton brought for exhibition the very rare thecated rotifer, *Melicerta tyro*, which he had recently found in a new habitat. Mr. Forrest read a paper by Mr. W. A. Lloyd, the curator of the Aquarium now in course of construction at Aston, and formerly for many years of that at Sydenham, "On the Principles of Aquaria." After reviewing the history of the earlier attempts to keep marine animals in confinement and the gradual development of the art of aquarium management, the author gave a highly

interesting account of his own experiments, the result of which was seen in his long and successful maintenance of the Aquaria at Hamburg and at the Crystal Palace, and then passed on to a description of the system of circulation and aëration which is about to be carried out at Aston. He also fully discussed the problem of the application to the purposes of the Aquarium of "artificial" or compounded sea-water, and gave particulars of the formula by which it may be best prepared. A vote of thanks was cordially given to Mr. Lloyd for his paper, which was profusely illustrated by a great number of beautifully executed diagrams, drawings, &c. Considerable discussion ensued, in the course of which Mr. Jones, the consulting chemist to the Aston Company, gave many highly interesting details as to the materials required. to the total amount of fifty tons, in the manufacture of the artificial sea-water for the Aston Aquarium, and the *modus operandi* to be pursued in that very important operation. The Chairman of the Section (Mr. W. R. Hughes, F.L.S.) presided.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY. —April 23. Mr. Josiah Austin read a paper on the vegetable alkaloids used in pharmacy. Their occurrence in nature, preparation, and effects on the human frame were described; and it was shown how much more satisfactory it is to prescribe these chemically pure substances instead of the raw materials, which contain such variable amounts of the active principles. Specimens of aconitia, atropia, strychnia, morphia, and quinia, with the plants from whence they are obtained, were exhibited.

CHELTENHAM NATURAL SCIENCE SOCIETY, May 22nd.—Mr. Day read a most interesting paper on "Vivisection, and what it has done for Science."

EVESHAM FIELD NATURALISTS' CLUB.—April 17th.—Mr. T. J. Slatter in the chair. Mr. A. H. Martin reported the following appearances of migratory birds:—Chiffchaff, April 2nd; Swallow, April 7th; Sand Martin, April 7th. Mr. T. E. Doeg read an interesting paper on "Some of the Birds of our Neighbourhood," illustrated by numerous specimens of their eggs. May 8th.—Mr. F. Wright in the chair. Resolved that the first excursion shall be on Saturday, May 24th, to Buckland.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.—NATURAL SCIENCE SECTION.—April 18th. Mr. B. Sturges Dodd read a paper on "The Stone and Wood-Penetrating Molluscs of our Coasts." Mr. Dodd directed attention to the power possessed by certain bivalve mollusca of boring in sand, wood, peat, and stone. The Phelades are the chief orders to which he referred, dated geologically from the Lias period. They were gregarious, and five species, all tolerably common, were to be met with on our coasts, inhabiting the littoral and coralline zones. They were phosphorescent, and lived and died in the holes which they excavated. The boring instinct was manifested at a very early stage; the animals being found in wood when so small as to be almost invisible. Some authorities stated that successive generations occupied the same hole, each individual living between the valves of the shell of its predecessor; and nests of five or six shells were sometimes found, one shell within the other. The Gastrochaenidae are distinguished by the case in which they are enclosed when arrived at maturity. This case appeared to be formed by a secretion of the mantle. Several exotic species are known, one boring in coral and another in granite. Several hypotheses have been advanced to account for the manner in which the Teredo, Pholas, and their allies bore into hard substances. The perforations are formed by means of the shells, which act as a sort of auger; the holes are made by rasping, by means of silicious particles embedded in the animal's body, currents of water set in motion by means of cilia, or the animals secreted an acid, the process being completed by rasping.—May 2nd.—MICROSCOPICAL MEETING.—Subject: Geology and Palæontology. Messrs. G. B. Rothera and J. Burton exhibited slides under microscopes. Mr. E. Wilson, F.G.S., exhibited a collection of fish teeth, obtained by him from Ticknall, and gave a description of them.—May 9th. Mr. J. Shipman read a paper on his recent "Discovery of coal measures, exposed at the surface, in the Trent Valley, at Burton."

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

SECOND ANNUAL MEETING, AT LEICESTER.

The Council of the Union met at one o'clock in the new Leicester Town Hall, on Tuesday, May 20th, 1879. There were twenty-six delegates present, representing sixteen societies. After the reading of the Secretaries' report, and the preparation of the business to be laid before the general meeting, the Council adjourned to the Royal Hotel, in Horsefair Street, where they were entertained at luncheon by the President, Mr. George Stevenson, together with the office bearers of the Leicester Literary and Philosophical Society, the Mayor of Leicester, (C. Stretton, Esq.,) C. Packe, Esq., (President-elect of the Leicester Literary and Philosophical Society,) &c.

During the progress of the Council meeting the visitors who were not engaged in officially representing the societies to which they belonged, were conducted to the principal objects of antiquity in Leicester by the members of the Archæological Section of the Literary and Philosophical Society, the arrangements having been made by the chairman (Mr. W. Kelly) and the hon. sec. (Mr. A. H. Paget.) The company met at the Museum, and proceeded to the Newarke, where Mr. W. Kelly, F.R.H.S., explained the celebrated gateway, pointing out that it was the principal entrance to the newest part of Leicester Castle, and derived its name of the New-works gateway in consequence. He further mentioned that a collegiate church formerly stood on the site of Mr. E. S. Ellis's house, and that the St. Mary's vicarage house and the residence of Mr. Lawrence Willmore were at one time canons' houses in connection with the church. Trinity Hospital was shown, and then the party walked on the turret gateway, which Mr. Kelly said was the old entrance to the Castle Turret. Thirty years ago, at a contested election for the county, part of the masonry fell, fortunately without doing any injury to anybody, and with a view to make the place a picturesque ruin (!), the old dome, which was perfect, was taken down by order of the Duchy of Lancaster, at the suggestion of Mr. S. Hardy. The stone work is now, unfortunately, crumbling away. Mr. T. Nevinson then explained the characteristics of St. Mary's Church, pointing out the interesting relics of Norman and early English work to be found there. He said the earliest part of the edifice would be erected about 1107, but other parts were added in 1170 and 1280. Mr. Kelly next conducted the party through the Castle, showed the traces of Norman architecture there, and then the Guildhall was visited. Mr. Kelly mentioned how the hall came into the possession of the Corporation after the dispersion of the Corpus Christi Guild, spoke of the uses to which it was put, and the circumstance that Shakespeare probably played in the hall. The Mayor's Parlour and Town Library attracted much notice, especially the chimney-piece in the first named apartment. St. Martin's Church was next entered, Mr. Nevinson explaining the principal features in the fine edifice, which, he said, however, was not so interesting as St. Mary's. A portion of the party then

proceeded to St. Nicholas' Church, in some respects, perhaps, the most valuable of all in the town from an archæologist's point of view. The early Norman work was pointed out by Mr. Nevinson and the vicar, (the Rev. T. W. Owen,) and both gentlemen agreed that some portion of the building was probably Saxon. Mr. Owen exhibited the first register of marriages and burials bearing date 1559, a deeply interesting volume, which he has had bound to better preserve it. Walking from the church, the house in St. Nicholas Street, in which it is supposed Bunyan once resided, and in which Dr. Watts on one occasion passed the night, was noticed, and the journey of the company was brought to a conclusion by a visit to the Jewry Wall and the Roman Pavement, which is preserved *in situ*, in a cellar close by.

GENERAL MEETING.

The annual meeting was held in the Council Chamber of the Town Hall, at half-past three o'clock, Mr. George Stevenson, of Leicester, (the President,) occupying the chair. The attendance, which numbered about seventy, included Mr. E. W. Badger, of Birmingham, and Mr. W. J. Harrison, of Leicester, the two honorary secretaries; the Rev. H. W. Crosskey, Dr. Deane, and Messrs. W. Graham, W. R. Hughes, G. H. Twigg, J. Morley, J. Rabone, A. Scruton, J. F. Goode, C. J. Watson, Alfred Hughes, C. Pumphrey, J. Levick, F. Underhill, H. Burman, Lawson Tait, H. J. Devis, and Bernard Badger, (representing various Birmingham societies;) Messrs. George Perry and Thomas Bolton, (Dudley,) Mr. Edwin Wheeler and the Rev. W. Katterns, (Peterborough,) Colonel Basevi and Major Barnard, (Cheltenham,) Messrs. J. S. Hedderley, L. Lee, A. H. S. White, G. B. Rothera, and J. Mosley, (Nottingham,) W. Phillips, (Shrewsbury,) the Rev. C. F. Thornewill, (Burton-on-Trent,) the Revds. O. M. Feilden and G. G. Monck, (Oswestry,) Messrs. F. T. Mott, T. Carter, C. Packe, J.P., W. Kelly, A. Paget, A. H. Paget, J. B. Everard, E. Clephan, W. Kempson, M. Maxfield, E. L. Stephens, W. Pilsbury, F. J. F. Kirby, H. S. Jones, and W. Emmerson, (Leicester,) the Rev. J. D. La Touche, (Stokesay,) the Rev. J. E. Vize, (Forden,) the Rev. J. M. Mello, (Chesterfield,) &c., &c.

After the minutes of the last meeting at Birmingham had been read by Mr. E. W. Badger, and duly confirmed, the President proceeded to deliver his address, which has already appeared in full in our pages (see Vol. II., p. 187.)

The Rev. H. W. Crosskey, F.G.S., moved a vote of thanks to the President for his admirable address, and expressed his agreement with the advice given by Mr. Stevenson. They might solve many problems by instruments which were at hand, and many discoveries might be made in every field of science if they would set about the work. The advice which the President had given them was sound, and if they were determined to make discoveries he believed they would succeed. He trusted that meeting would be the starting point in systematic effort in several scientific directions, and that the Chairman would be repaid for his address by seeing the members of the Union act on the advice which he had given. If they pursued scientific pursuits they would find a fund of enjoyment which would be most refreshing to them in the present day, when there was so much excitement, and so many differences, both on politics and religion, and when so many things were reckoned by their mere money value. In answer to those who wondered how it was they could take such interest in the studies that

had been referred to by the President, he might observe that all of them found in those studies their own sufficient reward, and he believed that in the heat and pressure and bustle of this modern life such studies were amongst the most reinvigorating and ennobling influences that could be brought to bear upon themselves and the society in which they moved.

The Rev. J. E. Vize seconded the motion, which was carried by acclamation, and briefly acknowledged by the President, who, in so doing, referred to the able and beneficial work which Mr. Vize, as a microscopist and a student of fungi, had lately done in his examination into the origin and precise nature of the disease known as diphtheria.

The following Report of the Council was then read by Mr. W. Jerome Harrison:—

At the first Annual Meeting of the members of the Union, held last year at Birmingham, the report of the Council included a general account of the origin and progress of the movement to that date. With regard to its origin, we may briefly recapitulate that the idea of a combination of the Scientific and Literary Societies of the Midland district was one which had occurred to many minds in many quarters, but that the actual commencement and practical inauguration of the work are due to the members of the Birmingham Natural History and Microscopical Society, who invited the other Societies of the Midlands to send delegates to a meeting, which was held in Birmingham on August 28th, 1877, at which the scheme was duly discussed, a council or governing body elected, and the Union constituted.

The first Annual Meeting of the new Union of Natural History Societies was held in Birmingham on Monday, May 27th, 1878. The attendance was numerous, and all the arrangements were prepared and carried out with great precision and success, under the direction of a committee appointed by the local scientific societies, and by Mr. E. W. Badger, upon whom, as the resident hon. sec. of the Union, there fell a great portion of the work. The excursion on the second day, Wednesday, May 28th, attracted a large attendance, and the arrangements for this were well carried out by the officers of the Dudley and Midland Geological and Scientific Society.

Of the present—the second Annual Meeting—it is as yet too early to speak. The winter has unfortunately been a very severe and prolonged one, and instead of the "sunny hours" which should characterise "flowery May," we have louring skies with cold east winds and rain, which cannot but have a detrimental effect upon the numbers attending from a distance. The Council desire, however, to record their recognition and appreciation of the earnest and thorough manner in which the Literary and Philosophical Society of Leicester has engaged in the arduous task of preparing for the accommodation, entertainment, and instruction of the many people of many tastes who are here met together. The Scientific Conversazione to be held this evening in the Museum Buildings is a new form of entertainment in Leicester, and the Council earnestly hopes that it may to some extent forward an appreciation of, and a liking for, scientific pursuits among the busy workers in this populous and flourishing town. To-morrow's excursion to Charnwood Forest only requires fine weather to prove most enjoyable, and also for those who have not previously visited that region, surprising in the character of its rocks and scenery. Leicester is to be congratulated on the vicinity of so splendid a field for the exertions of workers in natural science; if our grandfathers could have foreseen the spread of a love for the study of nature among all classes, and have foreseen too the great increase in the population of this country, we may think that instead of

"enclosing" and "disafforesting" Charnwood, as they did in the early part of this century, they would have retained it as a national park, have planted it, and cared for it, and preserved it a safe home for all that is wild and free in the native fauna and flora of our country. This is what it is proposed to do with the New Forest in Hampshire, and the Council, on behalf of the members of this Union, desire to express their entire sympathy with the Hon. Auberon Herbert in his efforts in this direction.

The official organ of the Union, the "Midland Naturalist," has been duly published monthly. It has attained a recognised position among scientific periodicals, and the testimonials from all quarters as to its success have been numerous and encouraging. It chronicles monthly the doings of the various societies of our Union, and many most interesting and valuable contributions on points both of local and general interest have already appeared in its pages. It is disappointing, however, to find that such a comparatively small proportion—not more than one-sixth—of the members of the Union are subscribers to what is really their own magazine. Every member should support it, not merely by his own subscription and by recommending it to his friends, but by recording and promptly forwarding to the editors all interesting facts of natural history and general science which may happen in his (or her) locality. The volume for 1878 forms a book of some 350 pages, and, as a permanent record of Midland science work and workers must always be of interest. Only a very few sets of this first volume are now left. For the extremely moderate price at which the magazine has been published, and the very satisfactory nature of its printing and general get-up, the Council desire to thank the publishers most sincerely.

As to the work of the past year the Council have to report that the following societies have joined the Union during the past twelve months:

(1.)—Peterborough Natural History and Scientific Society.
(2.)—Nottingham High School Natural History Society.
(3.)—Small Heath Literary and Scientific Society.

The complete list thus includes twenty-four Societies, viz.:—

Birmingham Natural History and Microscopical Society.
Birmingham Philosophical Society.
Birmingham and Midland Institute Scientific Society.
Birmingham School Natural History Society.
Burton-on-Trent Natural History and Archæological Society.
Caradoc Field Club.
Cheltenham Natural Science Society.
Derbyshire Naturalists' Society.
Dudley and Midland Geological and Scientific Society and Field Club.
Evesham Field Naturalists' Club.
Leicester Literary and Philosophical Society.
Northampton Naturalists' Society.
Nottingham High School Natural History Society.
Nottingham Literary and Philosophical Society.
Nottingham Naturalists' Society.
Oswestry and Welshpool Naturalists' Field Club.
Peterborough Natural History and Scientific Society.
Rugby School Natural History Society.
Severn Valley Naturalists' Field Club.
Shropshire Archæological and Natural History Society.
Small Heath Literary and Scientific Society.
Stroud Natural History Society.
Tamworth Natural History, Geological, and Antiquarian Society.
Woolhope Naturalists' Field Club.

The number of members is now about 3,000, and the great object of the Union is to make these members and their work known to one another, to unite them in single efforts, and to endeavour to guide them in lines of useful inquiry which shall lead to the increase of scientific knowledge, the education and development of the observing faculties, and so far as is possible the good of our fellow men. Already during the past year many pleasant friendships have been formed, and some scientific investigations started through the medium of our Union; working together and with definite aims we hope to achieve solidity and thoroughness in our undertakings, to supply advice and information to those who are in need of it, and to prevent the waste of time and energy with which the scientific record of the past is teeming.

The Treasurer's report will give particulars of the income of the Union during the past two years. £11 4s. 10d. was received up to last meeting, and £11 10s. 4d. since, making a total of £22 15s. 2d. The expenditure for the two years amounts to £28, details of which will be submitted to you. A resolution was passed at the last Annual Meeting "That it be a recommendation from this meeting that the annual subscription be raised, and that hon. secretaries be requested to report to a future meeting of the Union the opinions of their societies upon the subject." The opinions of such societies as have communicated them are almost unanimous. One society has expressed its willingness to pay whatever annual contribution your Council may fix; the others either recommend that it shall not exceed threepence per member, or state that they will not pay a larger sum. So long as the Union is not engaged in any work involving much expenditure, a nominal subscription will probably meet all disbursements; but, in an organisation numbering 3,000 members, it is obvious that a sum of one penny per member must be totally inadequate to defray even the cost of a circular to each member and the postage thereof. Three-fourths of the cost of the programme of the Birmingham meeting were defrayed by the local conversazione committee, who were so fortunate as to provide the members with a most instructive and enjoyable meeting, which was self-supporting. What will be done in the present year remains to be seen, though your Council are satisfied that the local Society has done everything in its power to ensure the success of our gathering. At the same time they cannot but feel that as the meetings of the Union must in turn be held in smaller towns where the members will be few in number, it behoves them to adopt such measures as will place at the disposal of the Union funds to supplement where needed those which may be forthcoming from the locality. For they cannot but think that these annual gatherings of naturalists in various parts of the midland counties must result in increased attention to the study of natural science, and they feel assured that all who have any interest in the encouragement of such studies will gladly co-operate by contributing where necessary to the expenses incurred by those who undertake the onerous duty of providing for the entertainment of such a large number of visitors as our experience so far justifies us in expecting at our annual meetings. Your Council, therefore, recommend that the annual subscription be raised to threepence per member.

Your Council have received an invitation from the Northampton Naturalists' Society to hold the annual meeting in 1880 at Northampton. They have had much pleasure in unanimously deciding to recommend this meeting to accept the invitation.

The Council regret to state that they have received the resignation of Mr. W. Jerome Harrison, one of the hon. secs. He has, however, consented to continue his connection with the "Midland Naturalist" as one of its editors. Mr. Harrison has resigned from a conviction that it

is necessary and will be beneficial for the Union that one of the hon. secs. should belong to the town in which the annual meeting is held.

The report was received on the motion of Dr. Deane, seconded by Mr. A. Paget.

Mr. A. H. Scott White moved the adoption of the report, suggesting, however, that the subscription for school societies should be one penny instead of threepence per member.

The Rev. C. F. Thornewill seconded the proposition.

Mr. Lawson Tait, in supporting the resolution, expressed his opinion that the Council should have power to reduce the subscription from threepence to a penny in the case of any affiliated society they thought proper.

Mr. E. W. Badger supported the suggested reduction, saying that he looked forward to the time when not only the endowed grammar schools of the large towns, but board schools in all parts of the country, would have their Natural History Societies, and that many of them might join the Union. (Hear, hear.)

The President endorsed Mr. Badger's remarks. He said he believed that the reflex action of such studies would have the highest value in the development of the character of boys and young men.

The report was then adopted, the suggestion of Mr. Lawson Tait being accepted.

The Treasurer's report, which was read by Mr. Badger, and showed a balance of £5 10s. against the Union, was, on the motion of Mr. Mott, seconded by Mr. Carter, also adopted; a vote of thanks being at the same time accorded to Mr. Badger for his services to the Union.

On the proposition of Mr. Mosley, Messrs. E. W. Badger (Birmingham) and G. C. Druce (Northampton) were appointed hon. secretaries, and Mr. H. E. Forrest (Birmingham) was elected assistant hon. secretary. Mr. Egbert D. Hamel (Tamworth) was re-elected treasurer.

Mr. Harrison read a letter which he had received from the hon. sec. of the Northampton Natural History Society, inviting the Union to hold its next annual meeting in 1880 at Northampton. On the motion of the Rev. O. M. Fielden, seconded by the Rev. G. G. Monck, and supported by Dr. Deane and Mr. Rothera, it was resolved to accept the invitation. It was stated by the Nottingham representatives that they hoped to invite the Union to visit that town in 1881.*

On the proposition of Mr. Graham, seconded by Mr. Lawson Tait, and supported by Mr. W. R. Hughes, a vote of thanks was passed to the Leicester Literary and Philosophical Society and the Leicester School of Art for their complete arrangements for the gathering of the Union this year, to the Corporation for allowing that meeting to be held in the Council Chamber, and to Mr. W. Jerome Harrison for his services as secretary.

The President responded, and a vote of thanks to him for his conduct in the chair terminated the proceedings.

After the meeting several gentlemen went on a visit to the Roman pavement in Jewry Wall Street, directed by Mr. A. H. Paget, while others inspected the muniments of the Corporation at the Town Hall, Alderman Paget pointing out their character and special points of interest.

* A formal invitation for 1881 has, since the meeting, been forwarded by the Nottingham Literary and Philosophical Society to the Hon. Secs. of the Union.

THE CONVERSAZIONE

was held in the Leicester Town Museum, on Tuesday, May 20th, from 7 30 to 10 30 P.M. A scientific conversazione was a novelty in Leicester, but the arrangements for the evening were so well planned, and so ably carried out, that we fancy the members of the Leicester Society will make an annual thing of it in future, so pleased did the local visitors appear to be with the rich stores of scientific objects which were exhibited and explained. The Leicester Town Council had resolved on permanently connecting the old and new Museum Buildings by a handsome structure which will serve as a receptacle for the Roman pavements, columns, &c., in which the Museum is so rich. Unfortunately this could not be completed in time for the meeting of the Midland Union, so a temporary corridor was put up connecting the new Lecture Hall with the Museum; the walls of this corridor were completely covered by scientific diagrams, lent by Mr. W. J. Harrison; some very fine diagrams illustrating botanical subjects were lent by Mr. F. T. Mott, others of rock sections, &c., were shown by Mr. Frank Rutley, and meteorological diagrams, by R. H. Scott, Esq., F.R.S.; these were all hung in the lower rooms of the Museum. In the New Lecture Hall a long centre table supported about forty microscopes, whilst on tables ranged against the walls were placed exhibits in general science, geology, biology, archæology, &c. The walls of the Lecture Hall were covered with a fine collection of pictures, lent chiefly by the Rev. A. A. Isaacs and Mr. G. Stannage, and in which the works of the local artists, Messrs. Fulleylove and Ward, were well represented. In the adjoining rooms of the School of Art an excellent collection of the works of past and present students had been arranged under the direction of the Head Master, Mr. Wilmot Pilsbury.

In speaking more in detail of the various exhibits we may class them under the following heads:—

MICROSCOPY.—Mr. Washington Teasdale (Leeds) exhibited some very fine specimens of ruled patterns on glass, also sections of *Nerium oleander*, showing cellular tissue breaking through cortical layer to form a leaf-bud, &c.; Mr. J. Levick, specimens of pond life; Mr. W. R. Hughes, numerous specimens of echinodermata and other objects illustrating marine zoology, prepared by Mr. Sharpus, of London; Miss Beale, three boxes of biological objects for the microscope; Mr. F. T. Mott, microscope arranged horizontally for drawing and measuring objects; A. Paget, Esq., fine binocular microscope; Mr. Thos. Bolton, two microscopes, with a large selection of living objects, rotifers, diatoms, &c., and revolving table, with slate top, for microscopical purposes; Mr G. C. Turner, micro-photographs; Mr. E. Wheeler, of London, 1,000 microscopical preparations, no two alike, including Nobert's lines, Moller's typen-platten, with three microscopes; Rev. J. E. Vize, microscope and slides of hepaticæ, fungi, lichens, mosses, &c.; Mr. J. Potts, circulation in frog's foot, &c.; Mr. Young, a Ross's binocular, with photographs, insects, &c.; also microscopes and miscellaneous objects by Dr. Emmerson, and Messrs. A. Baines, J. Morley, J. W. Burton, C. J. Watson, F. Parsons, F. Rutley, (rock sections,) &c., &c.

BIOLOGY.—Mr. B. Sturges Dodd (Nottingham) showed a very fine collection of British stone and wood-boring mollusca, with large illustrative diagrams; specimens of Atlantic ooze and forams, from great depths; British hydrozoa, and British marine algæ; Mr. H. F. Johnson, (Nottingham,) a pair of kestrel hawks, with six eggs; Mr. J. E. Weatherhead, a series of skulls of hippopotamus, dugong, &c., shells, as *Triton*, *Fusus*, *Chiton*, *Magilus*, &c., fine echinoderms, &c.; Mr. F. T. Mott, a collection of expensive and rare books on biological subjects; Mr. Theo. Walker, some exquisitely-prepared groups of British birds, set up

as in their native haunts, with all their natural surroundings. These have been done by Mr. Walker, as a gift to the new Natural History Museum at South Kensington.

GEOLOGY.—Mr. W. J. Harrison exhibited a complete series of the crystalline and metamorphic rocks of Charnwood Forest; Mr. J. R. Gregory, (London,) a grand group of *Trigonia clavellata*, a fern *Adiantites Hibernica*, from the old redstone of Kiltorcan; polished specimens of *Labradorite*, *Hippurites*; and large photographs of a restoration of the mammoth; Mr. J. E. Weatherhead, select specimens of minerals and fossils; Mr. J. S. Hedderly, (Bulcote,) flint implements from the coast of Lincolnshire; Dr. C. Callaway, Pre-cambrian rocks from Shropshire and South Wales; Mr. E. Wilson, (Nottingham,) *Ceratodus altus*, (tooth,) mountain limestone, fish-teeth from Ticknall, &c.; Mr. E. Hollier, (Dudley,) a magnificent collection of trilobites and other Silurian fossils from the neighbourhood of Dudley; Mrs. Islip, drawings of glaciers, &c.; Mr. C. Packe, geological maps, &c., of the Pyrenees; Mr. P. Mackennal, polished rocks, &c.

ARCHÆOLOGY.—Mr. H. Longhurst, collection of Egyptian antiquities; Mr. J. E. Weatherhead, Roman pottery and Loseby ware.

GENERAL SCIENCE.—Mr. W. J. Lancaster (Birmingham) had a very successful electric lamp, electric suspender, zoescope, and a large collection of physical apparatus, including telephones, (Reiss transmitter,) microphones, &c.; Mr. E. T. Loseby, a new method of insulating the wires of induction coils, and spun glass as a substitute for "spider-lines" in telescopes; Mr. F. Parsons, a collection of pneumatic, electrical, and photographic apparatus; Mr. T. Bolton, the collographic process of printing, by which numerous *facsimiles* were printed off from drawings done by the spectators; Mr. W. P. Marshall, the "rigid chain," devised by Dr. Hopkinson. Mr. Marshall has devised new experiments for this apparatus; he throws the rapidly revolving chain altogether off the pulley, and it continues to retain its shape for some seconds whilst rising through the air or moving along the ground; Mr. W. S. Franks, a five-inch achromatic refracting telescope, with equatorial stand. Spectroscopes were placed in a separate dark room. Mr. C. Packe exhibited his large instrument which very widely divides the D line, and others were shown at work by Messrs. E. T. Loseby, J. W. Burton, &c.

MISCELLANEOUS.—Mr. Barfield's carvings on wood and marble were much admired, as also were paintings on porcelain, by Abbott, exhibited by Mr. P. Mackennal.

The extensive collections in the Town Museum attracted the attention of visitors from a distance. The collection of Roman antiquities is very extensive and abounds in fine specimens, whilst the Natural History, Geological, and other collections, are also on a very large and complete scale for a provincial Museum. The Institution is rate-supported, and is also the head-quarters of the Leicester Literary and Philosophical Society, whose members have always taken the greatest interest in its prosperity.

Among other attractions of the Conversazione we must not omit to mention Mr. H. Nicholson's excellent band, which discoursed sweet music throughout the evening. The refreshments were well served by Mr. Roberts. The total number of visitors was about 400, and as the weather was propitious, it appeared to be generally felt that the affair was all that could be desired. The whole of the arrangements had been made by the Council and sections of the Literary and Philosophical Society of Leicester, the principal workers being Messrs. F. T. Mott, T. Carter, A. Paget, W. Kempson, E. F. Cooper, G. H. Garnar, C. Baker, and W. J. Harrison.

EXCURSION TO CHARNWOOD FOREST.

The programme of the second Annual Meeting of the Midland Union, held in Leicester, was carried out on the second day by an excursion to Charnwood Forest. A party of about 200 left the Museum at 9 30 A.M., being divided into two sections—one botanical and the other geological.

The botanical party numbered eighty-five, and were under the guidance of Mr. F. T. Mott, F.R.G.S. Among the visitors of well-known scientific reputation were Mr. W. R. Hughes, Mr. T. Bolton, Mr. J. Morley, Mr. J. Levick, Mr. W. P. Marshall, all of Birmingham; Rev. J. D. La Touche, of Stokesay; Rev. J. E. Vize, of Forden, Shropshire; Mr. G. B. Rothera, of Nottingham; Rev. O. M. Fielden, and others. The President of the Union, George Stevenson, Esq., with Miss Stevenson and Miss Florence Stevenson, were also with this party. The route was by Groby Pool, through Bradgate Park, Swithland Wood, Woodhouse Eaves, the Hanging Rocks, Beacon Hill, Hammercliff, Ulverscroft, and thence to Newtown Linford for tea. The lateness of the season making vegetation very backward was unfortunate for the botanists, but the weather was so mild and genial that this first foretaste of summer made up for the absence of many of the usual flowers. The Moonwort *(Botrychium Lunaria)* was found in two unexpected places. A specimen was taken from each locality for preservation in the herbarium of the Leicester Museum, in order that a permanent record of the discovery might be secured; but, with a self-control worthy of the members of a scientific society, but too seldom exercised among amateurs, the remaining fronds of this rare fern were left untouched, that it might not be extirpated and lost to Charnwood Forest like its congener *Osmunda regalis*. *Alchemilla vulgaris*, *Cardamine amara*, *Chrysosplenium oppositifolium*, *Polygonum Bistorta*, *Carex præcox*, *Teesdalia nudicaulis*, and a few others of the usual early spring flowers, were gathered in fine condition. Several of the party interested in microscopic fungi found a rich collecting ground in Swithland and other woods. About twenty species of mosses were collected, chiefly in Bradgate Park. *Volvox globator* was taken from a pond on Beacon Hill, and a fine colony of *Melicerta ringens* was procured by Mr. Levick, on a spray of *Ranunculus aquatilis* in Ulverscroft fish pond. During the stay at the Hanging Rocks, where the party sat down on various rocks and crags for lunch, Mr. F. T. Mott delivered an address on the "Colours of Flowers," which appears in the present number, (page 175.) On the conclusion of the address, the party ascended Beacon Hill, enjoyed for a few minutes the magnificent panorama visible from the summit, and then drove to Hammercliff, walking over the hill to the fish pond below. Here it was necessary to cross the broad weir which discharges the surplus water, and the only bridge was a narrow plank about nine inches wide and thirty feet long. The ladies and some of the more ponderous gentlemen looked aghast at this prospect. But necessity is the mother of courage as well as of other things, and the whole party came bravely and safely over, Mr. T. Carter distinguishing himself by the gallant assistance which he rendered to the ladies. The ruined Priory of Ulverscroft was then visited, and the party drove off to Newtown. The time was well kept, and Beck's was reached at four o'clock, the appointed hour, where a substantial and well prepared tea was awaiting them. Afterwards the party enjoyed a pleasant ramble in Bradgate Park. The geologists arrived an hour later, and both parties

returned home together, reaching Leicester at 7 30. The success of the excursion was heartily acknowledged, and was largely due to the exertions of Mr. G. Hull, one of the secretaries of the Society.

The geological party made their first halt at the syenite quarries near Groby Pool. Here Mr. Harrison pointed out the character of the rock—a crystalline aggregate of reddish felspar and green hornblende, with some quartz. The red marls of the Trias were seen dipping away from the syenite in all directions. Passing the botanical party at Groby Pool, the carriages drove rapidly through Bradgate Park to Swithland Wood. Here the deep slate pit was examined, and the stripe which denotes the eastward dip of the strata specially noted. Passing on through Woodhouse Eaves, the visitors next (by the kind permission of Mrs. Herrick) passed over the fine ridge of the Hanging Rocks. Here the leader enlarged on the physiography of the district, showing how the Charnwood Hills stood up above the surrounding plain by reason of their superior hardness, which enabled them better to resist denudation. Driving round Beacon Hill, the interesting quarry for hones, at Whittle Hill, demanded a flying visit. The rock here is a siliceous slate of fine texture. From this point to the Oaks Church the ground was quickly covered, and the party again dismounted to examine the stretch of wild moorland which lies between this point and the Forest Rock Hotel. The mode of formation of *logans*, or rocking stones, was pointed out by Mr. Harrison, and both at this point and at the great mass of volcanic agglomerate, which stands like a wall further on, the evident volcanic nature of the strata was described. Showered out from volcanic cones—perhaps many in number—the material of our Charnwood rocks formed stratified deposits, either on land or in shallow seas or lakes. These have since been greatly altered and denuded by the natural agents always at work—rain and rivers, frost, ice, and snow, chemical and electrical actions. They have alternately been depressed below, and raised thousands of feet above the sea level, until we find them at the present time forming a low chain of hills in the very centre of England, of strange and somewhat bizarre appearance when compared with the heavy clay land formed by the carboniferous, triassic, and liassic strata by which they are surrounded. Whilst baiting the horses at the Forest Rock Hotel, the High Towers ridge, with its singular breccia bed, was noted with interest, and the position of the great Coleorton fault, which runs at the foot of the ridge, and separates the Forest Rocks from the coal measures, was pointed out. Passing Bardon Hill, the Markfield syenite quarries were examined with much interest, and here the party had the advantage of the guidance of Mr. J. B. Everard. From this point Newtown Linford was soon reached, and tea enjoyed at the well-known Bradgate Arms, whose resources were taxed to the utmost, but provided satisfactorily for every one. A pleasant walk in Bradgate Park closed a very enjoyable and satisfactory day. Among the gentlemen from a distance of scientific reputation who accompanied the geological party were the Rev. J. M. Mello, of Chesterfield; Rev. T. F. Fenn, of Trent College; A. H. Scott-White, Esq., and Dr. Dixon, of Nottingham; Mr. E. Hollier, of Dudley; Mr. J. T. Cook, of King's Lynn; Major Barnard, of Cheltenham; Mr. W. H. Holloway, of the Government Geological Survey, &c.

The success of this combined excursion was great beyond anticipation. The arrangements were most complete in every respect, and, as in addition the day was gloriously fine, nothing was left to be desired. Mr. Harrison and Mr. Mott earned the grateful thanks of every excursionist for the admirable manner in which they conducted and instructed their respective divisions.

THE COLOURS OF FLOWERS.

BY F. T. MOTT, F.R.G.S.

There is a school of modern philosophers who assert that flowers are produced by insects, that their sole purpose is to attract insects, that their forms and colours have no other function whatever, and that without insects they could never have come into existence. Now, although I believe in the doctrines of evolution and selection, I do *not* believe in *this*. I think those doctrines are made to cover too wide a field; that their extreme advocates regard them too one-sidedly, and do not sufficiently take account of other natural laws and forces which are of equal importance. We may admit that insects have helped and hastened the development of coloured flowers, as a man who widens the channel of a stream helps and hastens the discharge of water, but that flowers could never have existed *without* insects seems to me an untenable theory. This one fact alone is I think fatal to it, viz., that before insect selection could possibly come into play colour must have been already developed to some extent; and surely the organic forces which were competent to originate colour are competent to perpetuate and to increase it, only give them time. It seems evident that there is in vegetable life some profounder cause for the development of coloured blossom than the mere external influence of insects. What *is* that cause? Consider what colour means. Everyone is now supposed to know that white light is compounded of a variety of coloured lights, which may be classified into three primary types, the red, the green, and the violet—the red being those in which the ether-waves are longest, the violet those in which they are shortest, and the green those in which they are of intermediate length. The colour of any object depends upon its power to stop, or neutralise, or absorb some of these waves, and to reflect the balance. A blue object is one which absorbs the long red waves and reflects the green and violet, the combination of these without the red giving the sensation of blue to our eyes. A yellow object absorbs the short violet waves, and reflects the red and green, whose combination produces yellow. A red object absorbs both the green and the violet, and reflects the red only, and so on. If all the waves are reflected without absorption or alteration, the object has a shining appearance, like glass or water, or some glazed leaves. But when they are not only all reflected, but very much scattered by a number of surfaces which are not parallel, then the object appears *white*. If all the waves are absorbed and *none* reflected the object is black. If some waves of all the different lengths are reflected, while some of them are absorbed, the colour will be *grey*. It would be *white*, only that there is too little light reflected altogether to produce the effect of white. Grey is simply a *dark* and *feeble* white. In the same way brown is a dark feeble yellow, olive a dark feeble green, and lead colour a dark feeble blue. Now look at the

colours which surround us in the vegetable world. The type of a perfect and complete vegetable is a flowering tree or shrub, such as a hawthorn, an apple, or a laburnum. In plants of this kind we have all the great systems of vegetable structure fully developed—the stem, the foliage, and the blossom. In herbaceous plants and all monocotyledons the stem system is imperfect; in cactuses and some euphorbias the foliage is never developed; in grasses, conifers, and many forest trees the flower system is defective; but in a true flowering tree you have everything complete. Look then at an apple tree or a laburnum; the prevailing colours in the stem and branches are brown, grey, or olive; in the foliage, green; in the blossom, white, pink, and yellow. And this relation of colour to each system of structure will be found throughout the vegetable world with few exceptions—dark feeble colours in the stem system, the primary green in the foliage, and the brilliant secondaries in perfected blossom. Now look a little deeper and see why this should be so. Stems are grey or brown because they absorb nearly *all* of the three component colours of white light, and in nearly equal proportion, reflecting a little of each. Leaves are green because they absorb *two* of the component colours, and reflect nearly the whole of the other. Flowers are yellow, blue, or pink because they absorb only *one* of the component colours, reflecting the other two. Here, then, is a regular gradation from the stem, through the foliage, to the flower. First three colours are absorbed, then two, and, lastly, one. How is this to be accounted for? It is not pretended that insects have anything to do with differentiating the foliage from the stem. Why should their interference be thought necessary in differentiating the flower from the foliage, which is a precisely analogous process? It is surely a process dependent upon the fundamental laws of organic growth. I think an explanation may be found, but it is, perhaps, too abstruse to be more than hinted at in this address. The absorption of light waves depends upon the molecular structure of the material on which it falls. Where such material contains molecules capable of vibrations of all lengths mixed up together, *all* the light waves will be absorbed. This is probably the condition of vegetable stems. When the molecules are so far sorted out and reduced to order that they will only vibrate in two modes, two only of the primary colours are absorbed, and the other reflected. This is the condition of leaves. When actual uniformity of molecular conditions is attained only one colour can be absorbed, the other two must be reflected, and the object appears brilliant with one or other of the showy secondary colours. This is the condition of flowers. I believe it can be shown that the reducing to order, and, finally, to uniformity of a group of very diverse molecules is one of the essential conditions of organic life; that the gradual development of colour is a necessary result of this universal law; that, therefore, coloured flowers were to be expected at a certain epoch in the development of this world, and that their number and brilliancy will still increase as the ages roll forward. Insects may help the process, but the great flood of organic life would not be stopped in its career though every bee and butterfly should perish.

CATERPILLARS: HOW TO FIND, AND HOW TO REAR THEM.*

BY THE REV. C. F. THORNEWILL, M.A.

I must confess to a certain amount of apprehension with regard to my subject of this evening how far its title may have tended to frighten away some proportion of my possible auditors. To many persons—and more especially perhaps to those of the fairer sex—a caterpillar is an exceedingly repulsive creature, known chiefly as a disagreeable intruder at the dinner-table when a careless cook has served it up in the company of the vegetables on which it feeds. To the British schoolboy—at all events in the days before natural science was so extensively taught in our schools as it is now—it was principally known as a thing to be stamped upon, or sometimes used as an instrument of torture upon a nervous schoolfellow; and I have recently heard of it, strange to say, as an unwitting agent for the encouragement of gambling, it being reported that the desolate condition of a certain estate in this neighbourhood is due to the former owner having lost all his money by betting upon races of caterpillars. "To such base uses," as the immortal Shakespeare has it, "may we all (even caterpillars) return."

But to-night I am going to speak of caterpillars as they appear to the eye of the Naturalist, and especially to that of the Entomologist. And to these—more particularly of course to the latter—a caterpillar, when not ridiculously common, is a treasure to be picked up with avidity, watched over with solicitude, and reared with care through all its stages, until it finally appears as a "bred specimen" in the well-secured drawers of his cabinet. One of the best specimens in my own collection, a fine *Acronycta Alni*, has such a history as this. I found the caterpillar, a splendid fellow in black and gold, crawling across the path one day in 1877, as I walked down from my house into the town; and, although I could have bought a perfect specimen from a London dealer for 15s., I felt quite as much pleased as if I had found a sovereign.

But I have undertaken to-night to give you some information upon two points connected with caterpillars, viz., how to find, and how to rear them. There are two members of this Society, if not more, who could have told you all about it much better than I can; but I tried both of them in vain, and at last I followed the advice of the proverb, "If you want a thing done, do it yourself."

First, then, let me give a few hints—partly gathered from my own experience, and partly derived from books—upon the best methods of finding caterpillars. There are three such methods commonly employed, viz., searching, beating, and sweeping; and of these three the first is of course by far the most scientific, and therefore the most to be recommended to the earnest student of nature. It consists in the examination, more or less minute, of the objects upon which the insects feed, with a

* This paper was read at the meeting of the Burton-on-Trent Natural History and Archæological Society, on Tuesday, April 8th, by the Rev. C. F. Thornewill, M.A., Vice-President of the Society.

view to the detection of their presence; and, although this may seem at first sight a very hopeless method of proceeding, it is remarkable how much success may attend it if pursued systematically and perseveringly. Two points, if borne constantly in mind, will help the collector greatly, and they are these:—First, that it is impossible for a caterpillar to live upon a plant without leaving some traces of its presence; and second, that we may generally expect to find in the outward appearance and colouring of the caterpillar some resemblance to that of the object upon which it rests. The great thing, then, in finding caterpillars is to educate the eye to discern the distinctions which exist between them and the objects on which they feed; and this sometimes is no easy matter. Some caterpillars resemble so closely pieces of stick, leaf-buds, &c., that it is almost impossible to detect them by any method short of actual touching. And the habits of many render them almost equally difficult of discovery. As a rule, caterpillars feed almost entirely by night; and during the day they rest either upon some part of the food-plant, or upon some object near to it. The best time for searching, then, is unquestionably at night—or, perhaps, to speak more accurately, in the dusk of the evening. At this time, aided by a lantern, we may sometimes take in favourable situations many species which are not otherwise easily to be procured, especially among the Noctuæ. And, indeed, it may be taken as a general rule that the caterpillars of this family are rarely to be taken during the day. Like the perfect insects into which they develop, they prefer the darkness and security of night; and if we wish to obtain them it is by night that we shall meet with the greatest measure of success. Some of even these, however, may be sought for during the day in their retreats. For example, the caterpillars of *Orthosia Upsilon* may be found sometimes in great abundance under loose pieces of bark on willow trees at the beginning of May, while *Cirrhœdia xerampelina*, a decided rarity, is to be met with about the same time among the loose rubbish and grass at the roots of ash trees. Not a few caterpillars are likewise to be found—at least, so it is said—during the early months of the year among the dead leaves, which may be gathered into a large bag and brought home to be examined at our leisure. The majority of the caterpillars, however, which we find during the day-time, belong either to the order of Bombyces or to that of the Geometræ. The former of these are not difficult to discover, being generally hairy, often brightly coloured, and feeding in much more exposed positions than do other caterpillars. It is as well, however, to be cautious about touching them, as the hairs often come off, and in some cases—as, *e.g.*, *Liparis chrysorrhœa*—possess irritating properties which produce painful swellings on the hands. The caterpillars of the Geometræ, on the other hand, are destitute of hairs and perfectly harmless; they lie during the day closely pressed to the mid-rib of a leaf, or the branch of a tree, the green species usually choosing the former situation, while those of a brown or buff tint prefer the latter. The best way to find them in such situations is to get underneath the tree and look up through the leaves against the sky, when the caterpillars will frequently be seen. Some of them, however, as well as some

species of Noctuæ, spin together two or more leaves into a sort of hut, in which they live by day, coming out at night to feed; and in order to obtain these we must of course examine the spun-up leaves. In this way *Tethea subtusa*, *Cymatophora flavicornis*, and several other species, may sometimes be obtained in abundance. Searching for caterpillars, however, is just one of those things in which practice makes perfect; and a little study of books at odd hours to see what species we may expect to find at any particular time, and upon what plants they feed, will enable us to save ourselves a vast amount of time and trouble. There are various manuals upon the subject—the best, in my opinion, being Merrin's "Lepidopterist's Calendar," which contains a list of the eggs, caterpillars, pupæ, and perfect insects to be found in each month of the year, and may be had interleaved with writing paper, on which to record the results of our own expeditions, a thing well worth doing in any case. But we are still without one list which to my mind would be even more useful—a list of plants, with the caterpillars which feed upon each. I wish I had the time and the ability to compile such a list, and thereby earn the gratitude of Entomologists for generations.

I might go on to say a great deal more upon the subject of searching for caterpillars; but it is time that I passed on to make a few observations upon two other methods of obtaining them, which, though less scientific, are certainly more expeditious—I mean "beating" and "sweeping." The former of these methods is employed to obtain those species which live upon the leaves of trees and shrubs, while the latter is used when we are desirous of getting those which feed upon grasses, dock, heather, and other low-growing plants. And the apparatus required, for beating at all events, is very simple, consisting of a large umbrella—an appendage which may be found useful in other ways likewise—lined with some light coloured material, or possibly even whitewashed inside, so as to render the contents more visible. This implement is unfurled when wanted, and placed upside down under the branch or shrub where we suppose caterpillars to be, while with the other hand we hold a stout stick, with which we strike the branch sharply and pretty heavily, when the caterpillars will fall into the umbrella, and may be picked up at our leisure. I remember upon one occasion last year obtaining about fifty caterpillars of *Fidonia piniaria* in this way, as the result of three or four strokes upon the boughs of a Scotch fir.

For "sweeping" we require a separate instrument, in the shape of a stout net, with the bag made of "cheese-cloth" or coarse canvas, and altogether more strongly made than the ordinary net. With this in his hand, the collector walks through the heather, fern, grass, or "what not," sweeping his net first to the right, then to the left, through the herbage, almost as if he were mowing, and stopping after every half-dozen sweeps or so to examine the result of his labours. I have not done much in this way myself, but in some situations it is a very effective method.

The caterpillars, when obtained, should be (with as little handling as possible) placed in boxes for conveyance to our homes, a leaf or twig of the food-plant being in all cases placed with them, and different species

being, as a rule, placed in different boxes, a course which will save a great deal of trouble when we get them home. It is well, too, to be on the look-out for cannibal caterpillars, and to make ourselves familiar as soon as possible with their appearance. Such bloodthirsty creatures as *Cosmia trapezina*, *Scopelosoma satellitia*, and *Crocallis elinguaria*, should obviously be left in no company but that of their own species, though even this is not always safe. And any collector who may meet with the ugly caterpillar of the goat-moth, *Cossus ligniperda*, had better put it in a tin box, if he wishes to get it home safely, as its powerful jaws will make short work of any wooden receptacle.

Supposing, however, that the collector has arrived at home in safety with his captures, he has still a great deal to do before the perfect insect appears as an addition to his cabinet. As soon as possible the caterpillars should be placed in a roomy box, furnished with a supply of the plant upon which they feed, and so arranged as to admit air and a moderate amount of light. Much light is not a good thing, except in the case of the hairy Bombyces, which seem to need it in order to keep damp from their long coats, and revel in the hot rays of the morning sun. But air is imperatively necessary; and in the cases of some species nothing less than absolute exposure in the open air will suffice to bring them to maturity. An example of this occurred to me last year. I had a number of caterpillars of *Polia Chi*, which I had reared from the egg. I had been warned that they required very liberal ventilation, and this object I sought to effect by putting them close to an open window. But it was all in vain, my caterpillars died off one by one, and not one lived to undergo the change into a chrysalis. Matters of this description can only be learnt by experience, and it is almost impossible to give any definite rules with respect to them. It is well to remember, however, as a general rule, that caterpillars want plenty of fresh air, and will rarely thrive in the close atmosphere of a living room. They should be kept, if possible, either in an out-house or in some place without a fire, and with abundant ventilation, but not exposed to the direct rays of the sun. With respect to cages, the best are undoubtedly those of the "meat-safe" pattern, made of wood, with sides of perforated zinc, and a glass front, which are sold by the London dealers for 2s. 6d. each. These, however, are somewhat expensive when one goes in largely for breeding, and are likewise not very well suited for single specimens. I have made use now for some years of small tin canisters, such as are used to contain cocoa; these, with a piece of gauze stretched over the top instead of a lid, and confined in its place by an indiarubber band, answer very well, though, of course, those caterpillars which go into the earth to change must be placed in another cage when approaching the period of their transformation.

For very young caterpillars I use the lids of the same canisters, with a gauze lid as before. But more experienced collectors than myself obtain the greatest success by placing the young larvæ in a tumbler, with a piece of glass laid on the top, thus forming an air-tight house, which will keep the food fresh for some time. And this is a matter of great importance. The great majority of caterpillars object very strongly to

dry or withered food; and it would obviously take too much time to provide fresh leaves for them every day; besides which, they should be moved or handled as little as possible. In some way or other, then, the food must be kept fresh; and this is effected either by sticking the stalks into damp sand, or else by putting them into a small bottle of water. In the latter case, we must take care that the water does not run out, by placing or supporting the bottle in an upright position; and, in addition to this, we must provide against the larvæ getting in, and coming in consequence to an untimely end by drowning. This they are prone to do; and, in order to circumvent their prepensities, it is well to wrap the food-stalk round with cotton wool, paper, or some other material, so that it may fit accurately into the neck of the bottle. By this means, food may be kept fresh sometimes for weeks, and much time and trouble saved to the collector.

With regard to food, a few hints may probably prove of service. Of course, when we can, we should feed our caterpillars upon the tree, shrub, or plant upon which they are found in a state of nature. But sometimes, from various causes, this is impossible. We may not know upon what plant, out of several growing together, a caterpillar has fed; or we may have taken it at a distance from home, and be unable to obtain a fresh supply. In such cases as these, what are called "substitute foods" come in very usefully; and upon this subject some valuable remarks may be found upon pages 34-38 of Dr. Knaggs' "Lepidopterist's Guide," which is in the library of this society.

But, speaking generally, our best chance of success will lie in offering to the caterpillars some plant belonging either to the same genus or to the same family as that upon which it feeds naturally; and for this purpose a little botanical knowledge is requisite. Sometimes, however, we do not know even so much as this; and then we must fall back upon what are called "generally favourite foods," such as knot-grass for the larvæ of Geometers, and plantain, dock, and lettuce for those of Noctuæ. It is not a good plan, however, to crowd the breeding cage, either with food or with too many caterpillars. We shall stand a far better chance of rearing the perfect insects if we confine ourselves to a moderate number of caterpillars than if we take all we can find. And it is desirable to remove all dead stalks of food, as well as other decaying matters, pretty frequently, if we wish to ensure the well-being of our charges, taking care, however, to look the old food well over, as otherwise we shall be very likely to throw away some of the caterpillars with it. It will be necessary, too, to supply now and then fresh water to the bottles which hold the food, and likewise to examine the fresh leaves before we put them in, so as to avoid introducing with them slugs, earwigs, beetles, or spiders, which will sometimes do great damage before they are discovered. Against cannibal caterpillars I have cautioned you before. But there are other enemies still worse, because very difficult (almost impossible) to guard against—I mean the tribe of Ichneumons. It is hardly too much to say that more than half of the caterpillars which we find abroad have already within their bodies one or more mortal foes in the shape of the larvæ of Ichneumons, which will

gradually eat away the whole inside of their victims, leaving nothing but the empty skin. Of course the earlier in life we obtain our caterpillars the more likely they are to be free from these pests, though we shall naturally have more trouble in rearing them. It is a choice of evils; but certainly it is worth while to take any amount of trouble rather than have our hopes destroyed by the appearance of a vicious-looking Ichneumon in the place of the moth we were so anxiously looking for.

It is well to provide a few pieces of bark and a little moss, or a few dead leaves, in our breeding cages for the caterpillars to hide under when not feeding, as they often enjoy a dark and cool place; and these also prove very useful when they are changing to the pupa state. We should also be careful to disturb our charges as little as possible while they are changing their skins, as they are then peculiarly liable to injury. But after all the best way to learn all the "dodges" with respect to caterpillar-rearing is to practise it regularly and steadily, observing carefully the habits of the different species, and treating them in accordance with what we know about their habits. Let me conclude by strongly recommending this practice of rearing caterpillars to all the young collectors who may be present. There are plenty of discoveries to be made in this field of observation. The caterpillars of our butterflies are many of them hardly known, and those of many moths very little more so. And until we know the habits of the caterpillar we can tell very little comparatively about the perfect insect. Above all, it is in this stage of the insect's life that we can exercise upon it most abundantly that faculty of observation which exists in all of us, but which requires exercise in order to bring out its full capacity, which, if we exercise it as we should do, will enable us indeed to find

> Tongues in trees, books in the running brooks,
> Sermons in stones, and good in everything.

MARINE ZOOLOGY AT ARRAN.—II.*

BY W. R. HUGHES, F.L.S.

The third marine excursion of the Birmingham Natural History and Microscopical Society, and the second annual one which was made to the Island of Arran for a week in the middle of July of last year, quite fulfilled the expectations of its promoters, and increased our knowledge of the marine zoology of the district, besides adding to it three specimens of Nudibranchs which have not been recorded in the very useful and interesting hand-book of the Island written by the late Dr. Bryce. A larger number of members than usual joined the party, which consisted of six ladies and twenty-two gentlemen. And it is significant as indicating the humanising influence which the study of natural history has upon the minds of those brought into communion with it, that the number included gentlemen of diverse political and religious opinions who do not often unite together for a common work; and as a natural

* Abstract of paper read before the Birmingham Natural History and Microscopical Society, 17th June, 1879.

result the most perfect unanimity and *bon accord* existed during our visit. Anyhow this is a gain to humanity if not to science! The general arrangements were similar to those adopted on our previous excursion but in many respects we improved upon them, and gained valuable experience. For the first time we had the advantage of a small steamer daily at our command, and, although the *Lizzie* was not altogether equal to our expectations, the saving of time and consequent addition to comfort was important.

As before, our dredgings were mainly confined to Lamlash Bay, the richest and most attractive ground. In the "Midland Naturalist," Vol. I., page 11, I gave an account of our captures during 1877, and, as we again took specimens of most of the species therein recorded, it is only necessary here just to allude to the additions which are of any special interest. The district, as stated previously, is richest in Echinoderms, and we secured specimens of every species observed on our last visit, with the exception of the somewhat rare aberrant form of *Thyone papillosa*. As a set off, however, we took a magnificent specimen of *Luidia fragilissima*, or Lingthorn, the glory of the late Professor Forbes, who has so graphically described its extremely brittle nature and its liability to break itself up into fragments immediately, if not even before, the dredge comes up. This star-fish is exceedingly interesting, not only from its comparative rarity, but because, as Forbes said, it is the "most remarkable and largest of all our British star-fishes." It is intermediate between the true star-fishes—those having ambulacral suckers—and the sea-urchins. Our specimen—notwithstanding the proverbial friability of the species—came up in the dredge entire, and a bucketful of pure sea-water having been speedily provided for its reception, we were enabled to examine and admire it and its moving spines and suckers in all their beauty. The specimen measured upwards of 18 inches across, was of brick red colour above, the under surface and lateral spines being a delicate straw colour. Well knowing its extreme friability, every means were taken to secure the specimen intact. It was preserved in sea-water for three or four hours, and, in order that when killed it should be unbroken, we carried it to a deep portion of the "brawling burn" in the grounds attached to the Brodick Hotel, and plunged it into fresh-water. Great and lasting, however, was our disappointment on returning to the hotel to see the rays one by one detach themselves at their junction with the disc, and presently not a single ray remained attached. If we had followed our "Carpenter," we might have killed the specimen without dismembering it, by immersion in glycerine; or, better still, by allowing it to die gradually in sea-water. In connection with the Echinoderms it should be mentioned that, although we were six weeks earlier than last year, and hoped by this we might secure some specimens of *Antedon (Comatula) rosaceus* in the stalked condition, not a single one was taken, all being in the free form, and many of them mature adults. It seems probable, therefore, that the specimens in the stalked condition which we took at Torquay in September, 1873, were the result of an abnormal second brood.

The very beautiful Nemertean annelid, *Carinella annulata*, another of the specimens taken, has been described by Dr. McIntosh as "one of the most handsome and graceful of the whole order." It was about two feet in length, the snout being wider than the rest of the body, and bluntly rounded anteriorly. The mouth is small. It is eyeless, with a white patch on the snout. The rounded body, when living, was of a rich red colour, passing into pink, striped longitudinally, and banded across at intervals by white belts. The development of Carinella has not yet been traced, but in an allied genus, *Lineus*, Johannes Müller, as referred to by Professor Huxley, (Anatomy of Invertebrated Animals, p. 186,) has shown that the ciliated embryo which leaves the egg is speedily converted into a body like a helmet with ear-lappets. The lappets are ciliated, and between them, where the head would fit into a helmet, is the mouth aperture, leading into a pouch-like alimentary cavity. Müller termed this larva *Pilidium gyrans*. That portion termed the Mesoblast gives rise to an elongated vermiform body, wherein the characteristics of a Nemertean soon appear. The worm on detachment carries with it the alimentary canal, the ciliated integument being left to perish. Professor Huxley observes "that in this remarkable process of development the formation of the Nemertean body may be compared on the one hand to that of a segmented mesoblast in Annelida, and on the other to that of an Echinoderm within its larva." The process of contraction and elongation peculiar to individuals in this order is wonderful, a specimen measuring several feet being capable of contracting to as many inches.

The three Nudibranchs referred to were all taken in Lamlash Bay. *Doto coronata* is a very beautiful and delicate animal. As usual, this was found on its favourite habitat, *Plumularia falcata*. Its filiform trumpet sheathed tentacles, and its body only half an inch in length, spotted all over, as well as the branchiæ, with brownish purple, made it a most charming object viewed by the two-inch objective, the pulsations of the heart (about sixty per minute) being readily perceived. *Doris pilosa*, another delicate little creature, is also not more than half an inch long, of pale, yellowish-brown colour. The branchial plumes of pearly white, freckled with brown, are exceedingly beautiful. Only one specimen was taken. *Ancula cristata*, also about half an inch long, is an elegant little Nudibranch. Its pellucid, tapering body, which permits the viscera to be plainly seen within, and its laminated tentacles and branchial plumes tipped with bright orange-yellow, mark it as one of the most beautiful of a beautiful tribe. We took many specimens of the little creature. Although not recorded in Bryce, the late Dr. Johnston is said by Alder and Hancock to have taken it off Holy Island, near which it was dredged.

One of the most interesting features of our last excursion was the effective display of microscopes. Under the able hands of Mr. Levick, Mr. Bolton, and Mr. Pumphrey, we were always sure of having any object of note well exhibited in the ladies' drawing room, in the evening, with every facility that "black back-ground" and other modes of illumination could afford. An improved tow-net, which was specially devised for us by Mr. Henry Allport, was used constantly with admirable effect.

This consisted of a metal rim, with lattice wire to keep out large objects, such as jelly-fishes, fitting into a stout outer rim of iron, to which was attached the bag made of bunting or muslin. Three small spring swivels attached as many lines to the rope which towed at our stern, or was left during the night, as the *Lizzie* lay at anchor in Brodick Bay, and collected a most interesting series of objects. We had thus the rare opportunity of examining the beautiful pseud-embryo stages of *Bipinnaria* and *Pluteus*, from which are developed the star-fish and sea-urchin. These pseud-embryos, or "zooids," are formed on a type quite different from that which characterises the adult animals, being bilateral instead of radial. In the last edition of his "Handbook to the Microscope," p. 609, Dr. Carpenter says, "This pseud-embryo seems to exist for no other purpose than to give origin to the Echinoderm by a kind of internal gemmation, and to carry it to a distance by its active locomotive powers, so as to prevent the spots inhabited by the respective species from being overcrowded by the accumulation of their progeny." Many other interesting larval forms, such as those of the crab and barnacle, were taken, as well as Radiolarians, Rotifers, and the *Noctiluca miliaris*, to which the phosphorescence of the sea on our coasts is mainly to be attributed. A small but very interesting collection of Algæ was taken and mounted by our most obliging friend, Mr. George Miles.

Several times during our dredging we had an opportunity of seeing the sea under exceptionally favourable conditions, not frequently observed. The weather was brilliantly fine, and had been so for several weeks before our visit. The wind was S.E. and almost a dead calm, and the sea smooth as oil, and clear as crystal. Not the slightest amount of sand or other detritus appeared mixed with the water, and thus we saw objects almost as plainly as though we were looking into a gigantic Aquarium. The bottom was in some places covered with the Chlorosperm algæ, *Ulva latissima*, and *Enteromorpha compressa*, like a lovely green grass plot. Between these, here and there, appeared a delicate Rhodosperm. Above these in places waved long broad fronds of the Oar-weeds *(Laminaria)* or slender filaments of the Whip-weed *(Chorda.)* Star-fishes and large sea-urchins were scattered among the vegetation, and the refraction of the light made some of them look, as our genial and accomplished friend, Mr. Sam. Timmins, (who has himself described it in his charming article on our visit in the *Daily Post* of 20th July, 1878) remarked, like "living turquoises." Occasionally fishes, both of large and small size, darted across. The depth in many places was between twenty and thirty fathoms.

And now we are looking forward hopefully to our forthcoming excursion to Falmouth. The Cornish coast has long been celebrated for its rich stores both of vertebrate and invertebrate marine life. The names of distinguished marine Naturalists who have investigated the fauna are as household words to us: Borlase, the historian, and Jonathan Couch, the eminent ichthyologist, and his gifted son Richard Q. Couch, who passed away so early in life; and Charles Peach, the Coastguardsman Naturalist, and the venerable W. P. Cocks. In many respects the fauna will be a contrast to that of Arran, which we have twice seen; but I venture with all confidence to say that, as hitherto, we shall be more than satisfied, and that we shall return, if not with any additions to the already well gleaned ground, certainly with large additions to our stock of knowledge and with increased admiration for and interest in the wonders of the "great deep."

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF MAY, 1879.

BY W. JEROME HARRISON, F.G.S.

STATION.	OBSERVER.	RAINFALL. Total for M. In.	Greatest fall in 24 hours. In.	Date.	No. of rainy d.	TEMPERATURE. Greatest ht. Deg	Date.	Great'st cold Deg	Date.
GLOUCESTERSHIRE.									
Cainscross, Stroud	W. B. Baker, Esq.	2·74	·74	27	14	92·0	20	27·0	10
Cheltenham	R. Tyrer, Esq.	2·80	1·00	28	21	66·0	21	23·4	10
Stroud	S. J. Coley, Esq	2·88	·75	29	17	67·0	23	27·0	8 & 10
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	2·55	·59	28	19	67·0	21	26·5	3
Woolstaston	Rev. E. D. Carr	2·25	·46	28	20	64·0	19 & 21	28·0	2
Leaton Vicarage, Shrewsbury	Rev. E. V. Pigott	1·65	·36	28	21	66·3	31	25·0	5
More Rectory, Bishop's Castle	Rev. A. Male	2·26	·37	28	22	67·0	18	26·0	3
Larden Hall, Much Wenlock	Miss F. R. Boughton	2·50	·55	28	21	64·0	21	31·0	2
Bishop's Castle	E. Griffiths, Esq.	2·11	·36	28	22	69·0	5	28·0	2 & 3
Cardington	Rev. Wm. Elliott	2·11	·52	28	21				
Stokesay	Rev. J. D. La Touche	2·02	·42	28	12	68·9	12 & 31	26·5	3
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	2·85	·82	28	22			24·0	3
Stoke Bliss	Rev. G. E. Alexander	2·75	·82	14	18	65·0	21	31·0	2 & 9
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq	2·88	·85	14	21	68·5	21	25·7	3
West Malvern	A. H. Hartland, Esq.	3·0[illegible]	·54	14	19	68·5	21	28·0	9
Pedmore	E. B. Marten, Esq.	2·97	·66	28	20	73·0	31	31·0	2
Longlands, Stourbridge	J. Jeffries Esq.	2·98	·60	28	20	72·0	21 & 22	26·0	2 & 9
Dennis, Stourbridge	Mr. C. Webb	3·74	·92	17	20	69·0	21	25·5	9
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	2·74	·69	28	19				
Dudley	Mr. J. Fisher	3·04	·61	28	17	74·0	30	28·0	9
Sedgley	Mr. C. Beale	2·74	·64	28	19	65·0	21	31·0	9
Kinver	Rev. W. H. Bolton	2·67	·64	14	20	70·0	21	26·0	2 & 9
Walsall	Mr. N. E. Best	3·10	·80	28	18	67·0	21	32·0	2
Grammar School, Burton	C. U. Tripp, Esq.	2·24	·31	13	19	69·0	5 & 21	24·0	10
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	2·81	·60	28	25	70·0	21	27·0	10
Wrottesley	E. Simpson, Esq.	2·61	·65	28	18	65·5	22	29·8	2
Heath House, Cheadle	J. C. Philips, Esq.	2·49	·31	31	15	61·3	21	28·0	10
Alstonfield Vicarage	Rev. W. H. Purchas	2·9[illegible]	·60	16	17	64·7	21	18·0	15
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	2·53	·67	28	18	70·0	31	29·0	9
Coventry	J. Gulson, Esq.	2·62	·72	28	18	27·0	3	71·0	22
Bickenhill Vicarage	J. Ward, Esq.	2·82	·65	28	19	65·0		45·0	
St. Mary's College	Rev. S. J. Whitty	3·22	1·08	14	16	67·1	21	28·6	10
Henley-in-Arden	T. H. G. Newton, Esq.	3·26	·75	28	19	66·0	5	26·0	3
Rugby School	Rev. T. N. Hutchinson	2·74	·77	28	17	66·6	5	26·0	10
DERBYSHIRE.									
Buxton	E. J. Sykes, Esq.	3·30	·71	15	20	63·1	21	23·0	10
Stoney Middleton	Rev. U. Smith	2·63	·61	29	10	62·0	5	11·0	9
Fernslope, Belper	J. G. Jackson, Esq.	3·10	·64	15	20	67·0	21	27·9	10
Brampton S. Thomas	Rev. J. M. Mello	2·70	·56	15	14	65·0	5	25·0	10
Linacre Reservoir	C. E. Jones, Esq.	2·84	·53	29	18				
Willersley Gardens	Jas. Tissington, Esq.	3·10			10				
Spondon	J. T. Barber, Esq.	2·98	·44	15	17			20·5	10
NOTTINGHAMSHIRE.									
Hesley Hall	B. J. Whitaker, Esq.	2·95	1·06	15	14	68·0	22	26·0	10
Tuxford	J. N. Dufty, Esq.	4·63				66·0	31	30·0	1
Hodsock Priory, Worksop	H. Mellish, Esq.	3·38	·64	14	19	65·3	21	27·8	3
Highfield House, Nottingham	E. J. Lowe, Esq.	3·56	1·21	14	19	68·8	21	24·9	10
Park Hill, Nottingham	H. F. Johnson, Esq.	3·80	1·12	14	19	65·7	26	32·3	9
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	2·29	·45	15	22	68·1	5	25·4	10
Ashby Magna	Rev. E. Willes	2·57	·68	28	21	72·0	21	24·0	18
Market Harborough	S. W. Cox, Esq.	3·09	·64	14	15	69·0	21	22·0	10
Kibworth	T. Macaulay, Esq.	3·11	·71	28	17				
Town Museum, Leicester	W. J. Harrison, Esq.	3·22	·79	14	22	67·3	21	26·8	10
Belmont Villas, Leicester	H. Billson, Esq.	3·25	·83	14	17	70·3	21	26·2	10
Syston	J. Hames, jun., Esq.	3·07	·56	14	26	75·0	5	25·0	10
Waltham-le-Wold	E. Ball, Esq.	3·98	·96	15	19	67·0	26	30·0	2
Little Dalby Hall	G. Jones, Esq.	3·57	·70	14 & 15	21	74·0	5	21·0	3
Foxton Locks	Union Canal Company	2·26	·57	28	17				
Coston Rectory, Melton	Rev. A. M. Rendell	3·90	·96	15	22	65·3	5	19·3	10
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	2·78	·93	28	13				
Castle Ashby	R. G. Scriven, Esq.	2·56	·82	28	16	67·0	31	29·0	9
Kettering	J. Wallis, Esq.	2·82	·65	28	17	68·0	22	30·0	10
Althorpe	C. S. Groom, Esq.	2·72	·73	28	16	68·0	21	24·0	9
Pitsford	C. A. Markham, Esq.	2·90	·83	28	19	71·0	6 & 22	26·0	3
RUTLAND.									
Burley-on-the-Hill	W. Temple, Esq.	3·83	·76	15	20	55·0	21	23·0	10
West Deyne, Uppingham	Rev. G. H. Mullins	3·15	·58	15	20	67·2	5	28·1	10
Northfields, Stamford	W. Hayes, Esq.	3·37	·57	15	17	64·0	20	25·0	5
Radcliffe Observatory, Oxford	H. E. Bellamy, Esq.	2·62	·95	28	14	64·7	5	29·6	9
Ventnor Hospital	W. T. Ryder, Esq.	2·06	·84	26	12	65·5	5	32·0	8
Altarnun Vicarage	Rev. G. Tripp	2·58	·59	28	19	68·0	31	25·0	3 & 8

Another cold, almost wintry, month, making the seventh in succession with a temperature below the average! Polar winds prevailed, varying from N.E. to N.W., but of moderate strength, with some calms. The nights of the 3rd and 10th were extremely cold, the protected thermometer falling at many stations to from 7° to 9° degrees below zero. The thermometer exposed on the grass at Leicester registered 12·2° on the 10th. Snow fell at several stations on the 1st, 7th, 9th, and 26th. During the first three weeks the barometer ranged high, the pressure during the last week being nearly half-an-inch lower, indicating the passage of numerous depressions from west to east, accompanied by very unsettled weather. Rainfall rather above the average. Thunderstorms occurred on the 1st, 11th, 14th, 26th, and 28th; that of the 14th was accompanied by a remarkable gloom, lasting at Buxton from nine to 10 45 A.M., and commencing at Orleton (near Tenbury) at 2 15 P.M. All observers concur in noticing the great backwardness of vegetation generally, which is estimated at one clear month behind the average.

NATURAL HISTORY NOTES BY OBSERVERS.—*Tenbury*—Cherry trees in blossom on 3rd; Damson, 7th; Pear, 23rd; Apple, 27th. *Pitsford, near Northampton*—Swallows first seen on 3rd. *Weston-under-Lyziard*—Cuckoo first heard, 4th; Landrail, 19th. *Waltham-le-Wold*—Hawthorn blossomed on 31st. *Alstonfield*—Vegetation more backward than in any season remembered. Ash tree only flowered towards the close of the month, and on the hills here still (June 5th) shows no leaf, although it does so in the warmer valleys to the south of us. Wych Elm (*Ulmus montana*) had, in the more forward instances, leaves barely half-grown on May 31st, while some of the later varieties had no leaves at all, only the nearly fully-formed seed vessels; Beech had leaves three-parts grown; Sand Martin seen on May 12th; Swift on May 14th. *Cheltenham*—Walnut Trees killed by frost of 10th; still black and leafless at end of month. *More Rectory, (Bishop's Castle)*—Bats flying on evening of 12th; Goldfinches andBlackbirds are abundant; Thrushes more rare; Common Wren scarce; Landrail heard on 29th. *Shifnal*—Oak only in tender yellow leaf on 29th, and some just bursting; Asparagus cut on 4th; Wild Cherry flowered 16th; Turtle Dove arrived 16th; Swifts, 17th; Martins, 21st; Flycatcher, 27th; Orange-tip Butterfly, 27th; Nightingale heard on 7th. *Castle Street, Bishop's Castle*—Swifts arrived on 1st; Corn-crake heard on 11th. *Stoney Middleton*—Oak and Ash just opening into leaf on 31st. *Park Hill, Nottingham*—Everything extremely backward; a spinney near here which at the beginning of May last year was over four feet high in *Æthusa* and Nettles, was this year scarcely over the boot tops. The number of nests built in holly hedges is extraordinary, they being the only ones capable of concealing anything. *Stroud*—List of flowers and date of blossoming:—1st, Blackthorn, Fœtid Hellebore; 7th, Garlick, Hedge Mustard; 8th, *Veronica polita*, *Ranunculus acris*, *R. auricomus*, *Prunus domestica*; 10th, *Saxifraga tridactylites*; 12th, *Polygala vulgaris*, *Orchis mascula*, *Carex præcox*, *Luzula campestris*; 13th, *Alchemilla vulg.*; 19th, *Cardamine amara*, *Viola tricolor*, Yellow Dead Nettle; 21st, *Barbarea vulg.*, *Ajuga reptans*, *Plantago lanceolata*; 22nd, Blue Bell, *Geranium Robertianum*, *Mœhringia trinervis*, *Orchis Morio*, *Stellaria nemorum*; 26th, Woodruff, Forget-me-Not, *Potentilla Tormentilla*, *Arum maculatum*, *Geranium lucidum*; 27th, Tufted Vetch, *Plantago major*, *Sherardia arvensis*, *Euphorbia helioscopia*; 28th, *Sanicula Europæa*; 29th, *Allium sativum*, *Lychnis dioica*; 30th, *Cochlear. officinal.*; 31st, *Carex pendula*, *Valerian. officin.* *Highfield House Observatory, Nottingham*—Narcissus, Wall Pears, Wild Cherry, fl. on 8th; Blackthorn and plum, fl. on 11th; Wild Hyacinth, fl., 23rd; Wisteria, fl., 25th; Lily of the Valley, Bird Cherry, fl., 26th; Landrail heard on 11th; Flycatcher arrived on 28th.

Correspondence.

CHRYSOSPLENIUM ALTERNIFOLIUM.—In answer to "Observer's" enquiry, I beg to say that I have found this plant twice this spring, once (about the middle of April) at Plaxtol, near Sevenoaks, and again (in May) at Loose, near Maidstone.—J. THORNHILL, Maidstone.

BEE-EATER.—I exhibited a fine specimen of that very rare bird, *Merops apiaster*, (Bee-eater,) at our Society's meeting on June 11th. It was shot near Derby, the day before.—L. LEE, Nottingham.

ORNITHOLOGICAL NOTES.—In my notes for last month, instead of "Merlin" (to whom I apologise for the mistake) I should have put the name of "Mr. Edwards," in respect of notes on the Hawfinch.—O. V. APLIN, Bodicote, Oxon, June, 1879.

THRUSH'S EGGS, &c.—Whilst out near here last month I found a thrush's nest, in which three out of the five eggs were perfectly plain and free from spots, the other two only having a very few. I should be glad to know if this is a common occurrence. On Whit-Tuesday, whilst rambling in some woods about eight miles from here, I came across a patch of *Paris quadrifolia*, and upon looking for any unusual forms, I found two plants with five leaves, but the other parts of the flower ran in fours, as is usual. On the same day I found very fine white specimens of *Myosotis sylvatica* and *Scilla nutans*.—H. F. JOHNSON, Nottingham.

ORNITHOLOGICAL NOTES.—This notice will complete the list of summer migrants, as the time for their arrival has now expired. Since my last communication I have noted the Swifts on May 14th, Redstarts May 15th, Yellow Wagtail May 23rd, Landrail June 8th, and Spotted Flycatcher June 13th. I have no doubt Ray's Wagtail was here on an earlier date, as I have observed the bird as early as the middle of April, and therefore the above date must not be considered as that of the *arrival* of the bird, but of my chance observation of it. It is not common, and may easily escape being seen for some time after its arrival. I have now recorded the arrival of twenty-three species, and there are of course some which have escaped notice, such as the Common Flycatcher, the Night-jar, the Whinchat, the Turtledove, the Quail, the Ring Ousel, the Red-backed Shrike, all of which have been seen in this neighbourhood in former years, and are doubtless here now, though overlooked. This would bring our list of ordinary summer migrants in South Leicestershire up to thirty at least. Some day I hope to be able to make the record complete. I hope your Oxfordshire correspondent will not feel offended if I say that he has not established beyond doubt the fact of the arrival of the Wryneck in that county as early as the first week in March. Should he succeed in proving that this bird ever takes precedence of all the spring migrants, and is heard three weeks in advance of the Chiffchaff, it will be something new. Meanwhile I venture to think that my theory, that the note was that of the Kestrel, is much the more probable. In your last issue I notice, as a curious coincidence, that your correspondent at Castle Ashby gives you the same date as myself for the arrival of the House Martin and the Nightingale.—THOMAS MACAULAY, M.R.C.S.L., &c., Kibworth, June 14th.

SEASONABLE NOTES.—Owing to the long-continued wet and cold weather, the spring and summer flowers are unusually backward this year. I first noticed the Purple Orchis *(Orchis mascula)* and the Crab trees *(Pyrus malus)* in flower, May 19th; Buttercups, *(Ranunculus bulbosus* and *R. repens,) Stellaria Holostea, Veronica Chamædrys, Ajuga reptans, Orchis Morio*, and Bluebell Hyacinths *(Scilla nutans)* were in flower by May 21st; *Viburnum Lantana* and *Paris quadrifolia* by 22nd; Hawthorn, which

is very late this year, 23rd; the Horse Chestnut and Lilac trees, *Asperula odorata*, *Rumex Acetosella*, *Poterium Sanguisorba*, May 29th; *Ranunculus acris*, *Ranunculus sceleratus*, *Berberis vulgaris*, *Arenaria trinervis*, *Vicia sativa*, and *Myosotis arvensis*, May 31st; *Potentilla anserina*, June 2nd; Laburnum, *Geranium Robertianum*, *Oxalis Acetosella*, *Valeriana dioica*, and *Veronica Beccabunga*, June 4th; *Geum urbanum*, June 7th; *Lychnis vespertina*, *Polygala vulgaris*, *Potentilla Tormentilla*, and Butterfly Orchis, (*Habenaria bifolia*,) June 9th; *Lotus corniculatus* and *Geranium dissectum*, first seen in flower June 12th; *Malva rotundifolia* and *Rhinanthus Crista-galli* in flower June 15th.—R. R., Castle Ashby.

SEASONABLE NOTES.—May 11th, Maythorn, bud, (flowered about 30th;) 16th, Oak, fl.; White Nettle, fl.; 17th, Wild Plum, fl.; 19th, Apple, fl.; 20th, Nightingale, at H. G. Tomlinson, Esq.'s, (Woodlands;) 24th, Ash and Sycamore, fl.; Early Purple Orchis, also a white variety; Glow-worm first seen.—C. U. TRIPP, Burton-on-Trent.

DISCOVERY OF A FOSSIL FRESH-WATER TORTOISE IN NORFOLK.—Remains of the common European *Emys lutaria*, obtained from the Post-glacial Freshwater-bed at Mundesley, have lately been brought under the notice of the scientific societies in Norwich. The specimen has been placed in the hands of Mr. E. T. Newton, F.G.S., and will shortly be described in the "Geological Magazine." In the meantime the fact of this discovery is of considerable interest, for only one other record exists of the occurrence of Testudinate remains in post-pliocene deposits in this country. The earlier discovery was communicated by Prof. A. Newton, (see his paper "On the Zoology of Ancient Europe," read before the Cambridge Phil. Soc., 1862,) and this consisted in the finding of remains of two individuals of the same species of Tortoise in a peat-bog at East Wretham, in Norfolk.—H. B. W.

BLACK BAND IN THE DRIFT.—In reply to Mr. Woodward's letter, which appeared last month, I regret that I have but little to add to my former communication. I was sorry to find that the bed in question does not extend far in the direction the cutting is being made, but appears to have its greatest dimensions at right angles, *i.e.*, east and west. The result is that the section is all but obliterated by the sloping banks which form the sides of the cutting. It was, however, too much decomposed to yield many recognisable remains, and after a careful search I have only found one good specimen. This appears to be a fragment of a twig from some tree or shrub, and is about two inches long by one-eighth of an inch thick. I have made enquiries from the foreman of the work, but the men have not met with anything sufficiently remarkable to attract their attention.—A. H. ATKINS, Birmingham.

Reports of Societies.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY.—WHIT-MONDAY, June 2nd.—EXCURSION TO STONEHOUSE AND DISTRICT.—A party of twenty-four members and friends left Birmingham at 6 30 for Stonehouse. Thence the way was taken, under the guidance of Mr. C. Pumphrey, over Doverow Hill to Randwick, just beyond which a quarry was found yielding an abundance of fossils. A most charming wood was next traversed, and many interesting plants collected. The walk was continued to the ancient camp on Standish Beacon, where a grand view was disclosed of the valley of the Severn, with the range of the Cotswold Hills stretching to the south, and on the other side the Malvern, May, and other hills. Signs of rain appearing, the party made a speedy return to Stroud, where tea was obtained. Afterwards some of the more enterprising of the party walked through the rain over the hills to Stonehouse, collecting fossils on the way.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—GEOLOGICAL SECTION.—May 27th.—Mr. Bolton exhibited *Brachionus pala*, one of the large shielded Rotifers, with two eggs attached. Mr. Waller exhibited photographs of some rock sections. Mr. C. Pumphrey gave some account of the Geological excursion to Charnwood Forest, on the occasion of the meeting of the Midland Union of Natural History Societies, at Leicester. Some discussion on the scheme for the united observation of glacial phenomena having taken place, the minute on the subject of the 22nd of October last was read. GENERAL MEETING.—June 3rd.—Mr. J. Morley exhibited bulbs of *Crocus nudiflorus*, from the Quarry, Shrewsbury. Mr. J. W. Cotton exhibited *Drosera rotundifolia*, *Polygala vulgaris*, *Pinguicula vulgaris*, and *Pedicularis vulgaris*. Mr. J. H. Pumphrey exhibited *Prunus Padus*, the Bird-cherry, from Millersdale, Derbyshire. Mr. H. E. Forrest exhibited *Tremella mesenterica*, a fungus, from Shrewsbury. Miss Ryland exhibited Geological specimens from Charnwood Forest. Mr. Walter Graham exhibited *Helleborus viridis* and other plants of the limestone, from the Doward Hill, near Monmouth; also, teeth and bones of extinct animals, from King Aurthur's Cave, Herefordshire. BIOLOGICAL SECTION.—June 10th.—Mr. J. E. Bagnall exhibited *Jungermannia excisa* and *J. sphærocarpa*, also *Saxifraga granulata*, from Sutton Park; *Tetraphis pellucida*, in fruit, from New Park, Middleton, a moss rarely found in this condition; also specimens of the long and short styled forms of Primula, the former of which is hairy, the latter only papillose. Mr. T. Bolton exhibited six slides given to the Society by the Rev. Lord S. G. Osborne, shewing the effects of carmine staining on animal and vegetable tissues. Mr. H. E. Forrest exhibited *Hydra vulgaris*, showing the ova and sperm-sacs; *Trifolium repens*, showing leaves with three, four, five, six, and seven leaflets; *Spirogyra quinina*, showing formation of spores from the contents of contiguous cells in the same filament, and various other fresh-water algæ. Mr. J. Levick exhibited *Pandorina morum* and *Uroglena volvox*, both from Sutton Park; and read a few notes on the latter. Mr. M. Browne exhibited *Euchelia Jacobææ*, the Cinnabar moth, taken at Bath. MICROSCOPICAL GENERAL MEETING.—June 17th.—Mr. A. W. Wills exhibited several species of *Spirogyra* and *Zygnema*, showing formation of spores in conjugating filaments, and in contiguous cells of the same filament. Mr. W. P. Marshall exhibited newt and newt-embryos, shewing the circulation in the gills while within the egg. Mr. J. E. Bagnall exhibited *Cephalanthera ensifolia*, *Myosotis umbrosa*, and *Helianthemum vulgare*, from Oversley Wood. Mr. J. W. Cotton exhibited *Botrychium Lunaria*, the Moonwort, from Barmouth. Mr. T. Clarke exhibited slides of Crystals of Sulphate of Copper. Mr. W. R. Hughes read some interesting notes on the marine excursion to Arran last year, including full descriptions of the more remarkable animals captured, and illustrated by preserved specimens of the Nemertean Annelid, *Carinella annulata* and stalked examples of *Antedon rosaceus*, in various stages of development.

BIRMINGHAM SCHOOL NATURAL HISTORY SOCIETY.—May 9th, Annual General Meeting, the President (Rev. A. R. Vardy) in the chair. The officers for the ensuing year were elected, as follows:—President—Rev. A. R. Vardy. Vice-Presidents—Rev. E. F. M. McCarthy, Rev. J. H. Smith, R. Levett, Esq., J. Turner, Esq. Hon. Sec.—H. F. Devis. Curators—Biological Section, J. Chapman; Geological Section, — Stokes. A. B. Badger exhibited *Philodina roseola* and *Floscularia ornata*. May 16th, General Meeting.—A paper was read by A. W. Swayne, on "A Walk at Llanthony." June 6th, General Meeting.—A paper was read by J. Chapman on "The Fertilisation of Plants."

CHELTENHAM NATURAL SCIENCE SOCIETY.—We mentioned at page 164 that Mr. Day had addressed the members of this society on the question "What has Vivisection done for Science?" We have since been favoured with a sight of a *resumé* of the paper, and heartily regret that our limited space does not allow us to offer a statement of the admirable way in which he put the answer. We cannot, however, debar ourselves of the pleasure of stating that a more thoughtful and well-reasoned exposition of the views of most intelligent biologists on the subject has not been seen by us. Mr. Day stated his views most dispassionately, and showed most conclusively that the interests of suffering humanity would be sacrificed, and the advance of scientific enquiry seriously retarded, if properly conducted experiments on the lower

animals were rendered illegal. We must content ourselves by giving Mr. Day's concluding remarks. He said:—"I have, although but briefly, sketched out how it has occurred that discussions upon vivisection have been raised during the last few years by those who do not believe anything has been discovered by their means. I have traced some of the advantages which humanity has reaped from these investigations, more especially as regards the circulation, the nervous system, and the therapeutic action of drugs; how, by its lessons, some prophylactics have been discovered, and the mode of treating asphyxiated persons has become more clear; how the changes in structures induced by disease have been followed out, step by step, and some organs, formerly unsuspected, are found to be the seat of certain complaints; how, by means of anæsthetics, operations have become painless, and, owing to the discovery of the antiseptic treatment, the pain of after treatment (as well as the mortality) has been greatly reduced; and, lastly, how by these means some poisoners have been convicted, and some persons unjustly accused have been saved from the gallows. But there are still many strong places to be attacked, remedies are required for many epidemics, as, for instance, cholera or fevers; or for poisons, as those of serpents; and curative agents, for the removal of disease; while a great boon would be an equally efficacious but safer anæsthetic than chloroform. The question is now narrowed into these grounds, first, that some experiments on living creatures are a necessity, but shall such be carried out in the wards of our hospitals and amongst patients? or on the convict population? or on the lower animals? Most of us in this room have been asked to sign petitions to except the lower animals from all experiments, thus throwing such upon human beings. The medical profession object to this plan, preferring the ancient adage, *Fiat experimentum in corpore vili.*"

DUDLEY AND MIDLAND GEOLOGICAL AND SCIENTIFIC SOCIETY AND FIELD CLUB.—The annual meeting of this Society was held on Wednesday, June 18th, at the Museum, Dudley. The report of the committee was read and adopted and the accounts passed. Dr. Fraser was elected as president for a second year, and some few names added to fill up vacancies in the committee. Mr. William Madeley was elected as secretary, an office which he held some years ago. A hearty vote of thanks was given to Mr. Marten, the retiring secretary. After slight luncheon, the members to the number of about forty started for the third field meeting of the season. Driving to Halesowen, after a look at the remains of the Manor Abbey, they inspected some interesting cuttings on the new line of railway from that place to Northfield, and then had a lovely walk, under the guidance of Mr. J. Amphlett, of Clent, from Romsley, through the romantic valley, near Farley Coppice and Shut Mill, to Walton and Hagley, having the usual meat tea at the Lyttelton Arms.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.—ANNUAL MEETING.—May 29th, 1879. The following officers for the year 1879 80 were elected:—President, Rev. R. A. Armstrong, B.A.; Vice-Presidents, Rev. Dr. Dixon, F.G.S., R. Enfield, T. A. Stephenson, M.D., J. White, F.R.C.S.; Treasurer, G. B. Rothera; Hon. Librarian, H. E. Hubbart; Hon. Secretaries, Isaac Mosley, A. H. Scott-White, B.A., B.Sc.; Council, J. Beddard, M.B., A. Brunner, M.A., E. Goldschmidt, A. L. Kohn, W. H. Ransom, M.D., C. L. Rothera, B.A., R. Simon, E. Smith, M.A., A. C. Taylor, M.D., E. Wilson, F.G.S.

CORRECTION.—In the title of a paper read by Mr. J. Shipman before the Natural Science Section, May 9th, (*vide* "Midland Naturalist," Vol. II., page 164, bottom line,) for "Burton" read "Beeston."

NOTTINGHAM NATURALISTS' SOCIETY.—May 21st.—A special general meeting was held to consider the subject of an amalgamation with the Nottingham Literary and Philosophical Society. It was decided, with only one dissentient, not to amalgamate. May 28th.—Meeting of the Botanical Section for the exhibition of specimens collected during May. Mr. A. G. Webster exhibited specimens of *Lathræa squamaria*, found on the root of the elm, and *Paris quadrifolia*. Other members exhibited specimens of *Saxifraga granulata*,

Geranium lucidum, &c. June 3rd.—A few of the members set out for a ramble in the neighbourhood of Loughborough, where, having arrived, they started by the Leicester road for Quorndon, on the left hand side of which, in a dyke, feeding on grass, was found, in abundance, the larva of *Odonestis potatoria*, (the Drinker Moth.) From Quorndon they passed on to Mountsorrel to inspect the Granite Quarries there. The deep ravine was grand and majestic. Quorndon Wood was then visited, where a rich flora was found, including *Convallaria majalis*, (Lily of the Valley,) and *Asperula odorata*, (Sweet Woodruff,) Yellow Lamium, (*Lamium galeobdolon*,) *Saxifraga granulata*, *Trifolium procumbens*, *Geranium lucidum*, Ferns, &c.

PETERBOROUGH NATURAL HISTORY AND SCIENTIFIC SOCIETY. —On June 2nd the members of this society had an excursion to Bedford Purlieus, permission having been granted to the society by Herbert E. Watson, Esq., steward to the Duke of Bedford. The party, consisting of twenty-three ladies and gentlemen, were under the guidance of the secretary, Mr. J. W. Bodger. The first halt was called at Alwalton, where half an hour was pleasantly spent in looking over the church; some interesting wall plants were obtained here. Chesterton Church was next visited, the Rev. — Gaudy kindly conducting the party and pointing out and describing the beautiful monuments erected to the memories of the Drydens and Nevilles; giving at the same time an account of these families. A lovely view of the surrounding country was obtained from the roof of the building. The rev. gentleman also showed the party over his gardens and surrounding grounds. Part of the programme had to be omitted, and the next stage was to the Purlieus, the favourite dwelling of many rare Northamptonshire plants. After dining the party dispersed by various paths into the depths of the wood, and returned laden with spoils.

SEVERN VALLEY NATURALISTS' FIELD CLUB.—EXCURSION TO BARMOUTH, June 10th to 13th.—Twenty-five members and friends of this club arrived at Barmouth on the afternoon of Tuesday, June 10th, quarters having been provided for them at the Cors-y-Gedol Hotel. A walk was taken to the panoramic view, a point on the hills above Barmouth, whence was seen in great beauty the scenery of the Mawddach, including the mountain ranges of Cader Idris and the Arrans. The sunset was one of remarkable beauty, the rich red afterglow continuing till ten P.M. On Wednesday, the 11th, the party drove along the north side of the estuary to Llanelltyd and thence up the valley of the Mawddach to a point where they alighted, and after a walk of two miles reached the Falls Pistyll-y-Cain and Pistyll-y-Mawddach, both of which were seen to great advantage, the sun shining brilliantly at the time. Near these Falls may be traced the junction of the Lingula Flags with the Cambrian Grit; outbursts of igneous rock (greenstone) are frequent. Lodes of metallic ore are numerous in the district. Near the Falls the party saw costly apparatus for gold washing, connected with the gold mine abandoned some years ago. Lead mining is, however, still carried on close to the Falls, the water from which supplies the power for driving the machinery for grinding and washing the ore. The Trilobite *Paradoxides Davidis* has been found near the Falls of the Mawddach Valley, but it is very scarce. A thunderstorm passing over prevented the visit to the third Fall, Rhaydr Du, and after sheltering at the little inn, Tyn-y-Groes, the party visited the small but picturesque ruins of Cymma Abbey, and after a drive back through the same noble scenery, reached Barmouth about six P.M. Thursday, June 12th.—An unsettled showery day, but the morning was on the whole favourable. The party drove by the Harlech Road to Llanbedr, and thence to Dolrheiddiog, whence they walked to Cwm Bychan lake and through the magnificent scenery beyond it, traversed by the path paved by the Romans with masses of Cambrian rock quarried on the spot, and known as the Roman steps. Weather cut short the walk after the summit had been reached, and in a pouring rain a retreat was made to the carriages, and Barmouth was reached about six P.M. In passing through the gorge of Cwm Bychat to Trawsfynydd, a fine section is obtained of the lower Cambrian grits and slates, and the scenery is remarkably wild. Friday, June 13th.—The party returned home by Cambrian Railway, leaving Barmouth at 12 35 P.M., Shrewsbury being reached at 4 45 P.M.

ENTOMOLOGICAL RAMBLES IN THE MIDLANDS.

No. I.—BEWDLEY FOREST.

BY W. G. BLATCH.

In a former paper on "Midland Entomology" I tried to prove, amongst other things, that the oft-repeated statement about the Midland Counties not producing any but the commonest insects was a fallacy. I now propose to take my readers, mentally, to several of the best hunting grounds in the district, especially such as lie within easy reach of Birmingham, and to point out some of the more interesting insects, from a collector's point of view, to be obtained from them.

Foremost amongst these is undoubtedly Bewdley Forest, and we have accordingly chosen that for our first Ramble.

Some "forests" to which I have been introduced are hard to find, and harder to see when you have found them, almost every distinctive feature having been long since swept away by the march of civilization; but this does not apply in the present case, the forest for which we are now bound being perfectly genuine.

Wyre Forest (its right name) is several miles in extent, and is situated between Bewdley, Cleobury Mortimer, and Arley, at the junction of the three counties of Salop, Stafford, and Worcester. Its distance from Birmingham is 22½ miles, and the railway journey occupies (by certain trains) about an hour. There are several ways of entering the forest, those most generally used being the Arley and Bewdley routes. The first is preferred by many Botanists and Entomologists, but the latter is perhaps the best, all things considered; we will therefore follow it on this occasion. Upon leaving the station we make for the fine bridge over the Severn, connecting Wribbenhall with Bewdley, and, having crossed it, turn down the steps on the right and go up the river-side as far as the quaint little church at Dowles. We then cross a bridge, turn sharp to the left, and, by ascending Dowles Brook, soon find ourselves surrounded by dense woods, and busily engaged in our entomological pursuits.

But, in truth, before we had left the side of the river our attention had been arrested by the myriads of dragon-flies, stone-flies, and other insects which sport amongst the rank herbage margining the bank, and our nets had been busily occupied in securing specimens of the pretty little moths, *Emmelesia albulata* and *E. decolorata*, that flit about so

softly and yet so merrily amongst the grass, strongly contrasting with the imposing colours, and fussy, whirring flight of the Burnet moths, *Zygæna filipendulæ*, and *Z. trifolii*, which accompany them. The sweeping-net of the Coleopterist has also been vigorously plied whilst walking along, and yielded upon examination quite a host of nice beetles, far "too numerous to mention." Amongst those "bottled" the Phytophaga preponderate, and include *Lema puncticollis*, *Crepidodera rufipes*, *Podagrica fuscipes*, *Psylliodes chrysocephala*, *Apteropeda graminis*, and *Coccidula rufa*. The Sternoxi were represented by *Lacon murinus*, *Cryptohypnus quadripustulatus*, *Limonius cylindrus*, *L. minutus*, *Athoüs hæmorrhoidalis*, *A. longicollis*, *Corymbites pectinicornis*, *C. cupreus*, *C. tesselatus*, *C. quercus*, and *C. holosericeus*; *Dasytes plumbeo-niger*, *Œdemera lurida*, *Hedobia imperialis*, and the curious *Notoxus monocerus* are also amongst our captures. Before leaving this spot, being reminded of the beetle-hunter's maxim, "Leave not a stone unturned," we carefully overhaul the stones and rubbish lying beside the river, and are rewarded by finding some good beetles, including *Clivina fossor*, *C. collaris*, *Chlaenius vestitus*, *Stomis pumicatus*, *Trechus discus*, and several species of *Bembidium*. We also find under stones close to and in the water *Orectochilus villosus*, and on the sand and mud *Cryptohypnus riparius*, *C. pulchellus*, *Potamnius substriatus*, and *Parnus prolifericornis*.

By beating the sallows at the mouth of the brook we obtain specimens of *Cryptorhynchus lapathi*, which fall into the umbrella apparently lifeless, and look like dry bird-droppings. We know these actors of old, or we might throw them away, not imagining them to be living beings. From the same trees we obtain those insect gems *Crepidodera nitidula*, *C. helxines*, *C. aurata*, and *C. chloris*, as well as (from alder) *Campylus linearis*. By the side of the brook, on the fig-worts, *Scrophularia aquatica* and *C. nodosa*, we find the pretty tesselated beetles *Cionus scrophulariæ*, *C. hortulanus*, *C. blattariæ*, and *C. pulchellus*, whilst, on the rising ground on the right, by sweeping amongst wood-sage, we obtain the compact little *Gonioctena litura*, which, when captured for the first time, is almost always mistaken for a species of *Cryptocephalus*. A few steps further, on the railway bank, real *Cryptocephali* may be found, viz.:—*C. aureolus* and *C. moræi*, the latter, a pretty shining black insect with orange spots, on *Hypericum perfoliatum*, sometimes in numbers. On the same plant, and in the same place, we take *Chrysomela varians* and *C. hyperici*. By beating the broom, growing so luxuriantly all around us, we find the larvæ of *Pseudopterpna cytisaria* and *Chesias spartiata*, as well as the uncommon (at least in our district) *Apion fuscirostre*. Having left the railway we descend towards the brook again, plucking a handful of moss from the bank as we go. From this we shake out on to a sheet of paper carried for the purpose the curious, almost spider-like weevil, *Orobitis cyaneus*, and the tiny seed-like *Mniophila muscorum*, besides some Pselaphidæ, including *Bryaxis juncorum*, *Pselaphus Heisei*, *Scydmænus*

Godarti and *Cephennium thoracicum.* Stopping to examine some fine plants of the rather rare *Helleborus viridis*, we notice, close by, a dead hedgehog, strongly appealing to our sense of smell, and not in vain, for, knowing that what is so offensive to us is considered a rich treat by certain members of our favourite order of insects, we carefully and expectantly turn it over and examine it, being rewarded for our pains (literal meaning, if you please!) by several fine beetles. Amongst them are two or three species of *Choleva*, the Burying Beetles *Necrophorus humator*, *N. mortuorum*, and *N. vespillo; Silpha littoralis*, *S. thoracica*, and *S. sinuata*, also come forth in plenty; whilst Histers positively abound, and *Nitidula bipustulata*, *Omosita colon*, and *O. discoidea*, swarm upon the remains of poor "spiny." Of course there are also a good many "Staphs"—*Aleochara*, &c., but nothing to be specifically noted.

In rising from our unsavoury, but, withal, profitable beetle-trap, our attention is riveted on a handsome caterpillar feeding on the hawthorn above us, and which we recognise as the larva of *Trichiura cratægi* (one of the Bombycidæ,) which, if we take it home and carefully feed it, will become a moth in August or September, proving an acquisition to our cabinet.

We are now fairly in the forest, and find so much to claim our attention that it is at first somewhat bewildering. A little too early for the Silver-washed Fritillary, *Argynnis paphia*, the dark variety of which, *valezina*, also occurs here; and the Purple Hair-streak, *Thecla quercus*, (of which two or three laggard larvæ, which ought to have completed their feeding and changed to pupæ before this, have fallen to the beating stick,) we are gladdened with the sight of scores of "Pearl borders," *Argynnis euphrosyne* and *A. selene*, flitting about all around us, the former somewhat worn and showing signs of living beyond its time. Ah! what have we now? Not a Black-veined White, certainly, visions of which have more than once crossed our minds, and which is reported to have been formerly found here; nor a Camberwell Beauty, a butterfly assuredly netted here, once at any rate, not many years ago; but, fluttering in our net, we have a very interesting butterfly, nevertheless, viz., the "Greasy Fritillary," *Melitæa artemis*. This is soon boxed, and the net again in requisition. This time we have taken two curious day-flying moths, "Mother Shipton" and "Mother Shipton's Likeness," *Euclidia mi* and *E. glyphica*, the former having a droll caricature figure of a human face on each fore-wing. Here also is *Phytometra ænea*, likewise a lover of sunshine; and, flitting about in the shady parts of the walks, the prettily speckled Geometer, *Venilia maculata*. Sitting on the flowers in the hot sunshine, busily sipping their sweets, are several specimens of the small Angle-shades moth, *Euplexia lucipara*, and in yonder shady opening in the wood, moving with ghost-like flight, is the Wood-white butterfly, *Leucophasia sinapis*. Having boxed as many as required of the former, and netted the latter while at rest on a "lady's smock," we pass towards a number of large purplish flowers, descried growing just within the margin of the wood, and which prove to be those of two species of

Geranium, *G. sanguineum*, and *G. sylvaticum*. Whilst moving towards these, we notice a large and strikingly beautiful moth sitting on an oak leaf, and of course stop to examine it. It is one new to us, and we feel all the thrilling pleasure of a "first find." We gloat over it—the delicately outlined markings, and the silvery, pearly-gray gloss on the wings are inexpressibly exquisite, and a fine crest on the thorax, gently stirred by a passing zephyr, seems to be waved at the will of the insect. It is so lovely, and spreads all its riches of beauty so unsuspectingly before us, that we shrink from the idea of laying violent hands upon it. But the moth is the Silvery Arches, *Aplecta tincta*, and our cabinet hitherto knows not the species! Acquisitiveness overcomes sentiment, and in a moment the rarity is ours! In capturing it (of course you must understand that "perfect coolness" steadied our hands!) we rustle the tree, and out fly two other prizes, by name *Limacodes testudo* and *Lithosia mesomella*, which soon share a similar fate.

Now for the Geranium flowers, in which we find, quite in the centre of the blossoms, a chubby, rugose, intensely black-backed, white-bellied little weevil, which feigns death and falls to the ground at your slightest touch of the plant on which it is resting. This is a good catch, and rejoices in the name of *Coeliodes geranii*. We take plenty "for selves and friends," but scarcely seem to diminish their numbers. Two, male and female, in one flower, are common, and often three—generally one male and two females—occur in a single bloom. They eat the petals of the flower, and seem to like such fairy-food, as indeed they ought. But, tempting as these little beauties are, we must move on, seeking "fresh fields and pastures new." Lo! here, "where the bee sucks," is fine sport. In front of us is a grand specimen of the Guelder rose in full bloom, and swarming with insects. Where shall we begin, and what shall we take first? Beetles first, decidedly, and Longhorns before everything, and so we attack accordingly. *Clytus arietis*, *Rhagium inquisitor*, *R. bifasciatum*, *Toxotus meridianus*, *Pachyta collaris*, *P. octomaculata*, *Strangalia quadrifasciata*, *S. armata*, *Leptura livida*, and *Grammoptera ruficornis*—all are here, and all are captured. Some of them so covered with pollen-dust that it is hard, at first sight, to tell what they are. This is particularly the case with *Pachyta collaris*, which, instead of his usual genteel blue-black coat and red waistcoat, looks as if he had been made tipsy and then rolled in a baker's trough, "for a lark." We are glad to have him, though, and feel already more than satisfied with our success. There is, however, more work yet to be done before retracing our steps. But first let us think of responding to an increasingly powerful appeal from the "inner man," and, with that view, make bold to enter the house at Cooper's Mill, placed hereabouts as if on purpose to meet our gastronomic requirements. Mrs. Weaver, always kind and obliging, provides a bountiful supply of ham and eggs, and brews some excellent tea, upon which, with plenty of her own home-made bread, we regale ourselves with the relish inspired by good fare and keen appetites.

[TO BE CONTINUED.]

NOTTINGHAMSHIRE LAND & FRESHWATER SHELLS.

BY E. J. LOWE, F.R.S., ETC., AND C. T. MUSSON.

The following list of the Nottinghamshire Mollusca may be of use to some readers of the "Midland Naturalist." It is corrected to the present time, June, 1879.

AQUATIC.

CLASS I. CONCHIFERA OR BIVALVES.

FAMILY I., SPHÆRIIDÆ.

GENUS I., SPHÆRIUM.

Sphærium corneum, very common.
var. Pisidioides, Canal at Beeston.
var. flavescens, at Beeston.
var. nucleus, at Beeston.
rivicola, common in the Trent and the Canals.
ovale, rare, Canal at Beeston (B. S. Dodd.)
lacustre, Ponds at Beeston and Barton.
var., brochoniana, Clumber Lake and Attenborough.

GENUS II., PISIDIUM.

Pisidium amnicum, common in the Canals and River Trent, at Beeston.
fontinale, ditch at Barton.
var. pulchella, dyke at Beeston and Stanton-on-the-Wolds.
var. cinerea, Beeston and Lenton.
pusillum, Canal at Nottingham and elsewhere.
var. obtusalis, rare at Beeston.
nitidum, Beeston and Nottingham Meadows, not common.
roseum, rare at Sawley.

FAMILY II., UNIONIDÆ.

GENUS I., UNIO.

Unio tumidus, common in the Trent and the Canals.
var. radiata, not uncommon in the Canals.
var. ovalis, common.
pictorum, common in the Trent and the Canals.
var. radiata, Highfield House Lake.
var. curvirostris, " " "

GENUS II., ANODONTA.

Anodonta cygnea, common.
var. rostrata, Canal, Beeston.
var. radiata, Canal, Wollaton.
anatina, Canal, Wollaton, and several varieties.

FAMILY III., DREISSENIDÆ.

GENUS DREISSENA.

Dreissena polymorpha, common.

CLASS II. GASTEROPODA OR UNIVALVES.

ORDER I., PECTINIBRANCHIATA.

FAMILY I., NERITIDÆ.

GENUS NERITINA.

Neritina fluviatilis, common on submerged stones.

FAMILY II., PALUDINIDÆ.

GENUS I., PALUDINA.

Paludina vivipara, common.

GENUS II., BYTHINIA.

Bythinia tentaculata, very common.
var. decollata, Lenton and Attenborough.
Leachii, rare, ditch, Nottingham Meadows.

FAMILY III., VALVATIDÆ.

GENUS VALVATA.

Valvata piscinalis, common.
var. depressa, common.
cristata, ditches at Bulwell, Attenborough, and Nottingham, very plentiful.

ORDER II., PULMONOBRANCHIATA.

FAMILY LIMNÆIDÆ.

GENUS I., PLANORBIS.

Planorbis lineatus, brook at Oxton Bogs, and Highfield House Lake.
nitidus, rare, in Canal at Lenton and Nottingham, and Highfield House Lake.
nautileus, plentiful in ditch at Bulwell, and lake at Highfield House.
albus, rare, Bulwell and Lenton, and Canal at Nottingham.
glaber, Beeston and Mapperley, in ponds.
spirorbis, common.
vortex, ,,
var. compressa, Stanton-on-the-Wolds.
carinatus, common
complanatus, ,,
corneus, ,,
contortus, very plentiful at Bulwell, Colwick, and Canal at Nottingham.

GENUS II., PHYSA.

Physa hypnorum, plentiful at Beeston in ditches and ponds.
fontinalis, common.
var. curta, Beeston Meadows.
var. inflata, Lenton.

GENUS III., LIMNÆA.

Limnæa glutinosa, rare, Beeston Lock, in backwater of Trent.
peregra, very common.
var. ovata, very common.
var. oblonga, common.
var. acuminata, ,,
var. decollata, not uncommon.
auricularia, Canal at Nottingham and Wollaton.
var. acuta, lake at Highfield House.
stagnalis, common.
var. fragilis, common.
palustris, very common.
var. tincta, Beeston and Lenton.
var. corvus, Sawley.
var. decollata, not uncommon.
truncatula, plentiful in Trent at Beeston, ditch near Mansfield, also at Edwinstone and Lenton.
var. elegans, Beeston.

GENUS IV., ANCYLUS.

Ancylus fluviatilis, common on submerged stones.
var. albida, plentiful in a stream at Bulwell.
var. capuloides, Tottle Brook.
lacustris, Beeston and Radford.

TERRESTRIAL.

FAMILY I., LIMACIDÆ.

GENUS I., ARION.

Arion ater, common.
hortensis, „
flavus „
unnamed species, Highfield House.

GENUS III., LIMAX.

Limax flavus, Lenton and Nottingham.
agrestis, common.
arborum, trees at Wilford and Welbeck, &c.
maximus, Welbeck, &c.
lævis, Highfield House.
marginatus, Highfield House.

FAMILY II., TESTACELLIDÆ.

GENUS, TESTACELLA.

Testacella Haliotidea, Welbeck Gardens, (R. A. Rolfe.)

FAMILY III., HELICIDÆ.

GENUS I., SUCCINEA.

Succinea putris, common, and several varieties.
virescens, Sawley, Thrumpton, and Lenton.
elegans, not uncommon.

GENUS II., VITRINA.

Vitrina pellucida, common.

GENUS III., ZONITES.

Zonites cellarius, common.
alliarius, „
nitidulus, „
purus, Wollaton, Pleasley, and Creswell Crags, not uncommon.
radiatulus, common.
nitidus, „
excavatus, rare, at Attenborough.
crystallinus, common.
fulvus, plentiful at Wollaton, Stanton-on-the-Wolds, &c.
glaber, Highfield House, Sawley, Wollaton, &c.

GENUS IV., HELIX.

Helix aculeata, not uncommon at Thrumpton, Wollaton, and Stanton-on-the-Wolds.
aspersa, common.
nemoralis, common,
var. hortensis, plentiful on a roadside at Stanton-on-the-Wolds, and at Bulwell, rare.
var. hybrida, plentiful in a lane at Basford and Wollaton.
var. minor, Thrumpton.
arbustorum, Hazelford and Thrumpton.
concinna, common.
hispida, „
var. albida, not uncommon.
rufescens, rare.
sericea, rare, Clifton and Highfield House.
revelata, Stanton-on-the-Wolds.
fusca, rare, Highfield House.
virgata, (1 sp.,) Lenton Hall.
caperata, Creswell Crags, plentiful, also Ruddington, and Stanton-on-the-Wolds.

Helix ericetorum, Stanton-on-the-Wolds.
var. alba, ,,
rotundata, very common.
var. turtoni, Highfield House.
pygmæa, not uncommon, at Wollaton and elsewhere.
rupestris, not uncommon.
pulchella, not uncommon.
var. costata, not uncommon.
lapicida, one live specimen and fifteen dead ones at Creswell Crags; also at Pleasley Vale, under stones and leaves, on magnesian limestone district.

GENUS V., BULIMUS.

Bulimus obscurus, not uncommon at Stanton-on-the-Wolds, Colwick, Creswell Crags, and Pleasley Vale.

GENUS VI., PUPA.

Pupa umbilicata, very plentiful at Sutton-in-Ashfield and Creswell Crags; also at Chilwell.
var. edentula, Highfield House.
secale, Nottingham Castle.
ringens, rare, Highfield House.
marginata, rare, Highfield House.

GENUS VII., VERTIGO.

Vertigo pygmæa, rare, Widmerpool and Pleasley Vale.
substriata, rare, Highfield House.
edentula, plentiful at Widmerpool, and rare at Wollaton.
antivertigo, Highfield House.
pusilla, Highfield House.

GENUS VIII., BALIA.

Balia perversa, rare, Colwick (B. S. Dodd.) and Highfield House.

GENUS IX., CLAUSILIA.

Clausilia rugosa, very common.
laminata, one dead specimen at Pleasley Vale.

GENUS X., COCHLICOPA.

Cochlicopa tridens, five dead specimens at Pleasley Vale; also recorded at Highfield House, Beeston.
lubrica, very common.

GENUS XI., ACHATINA.

Achatina acicula, one dead specimen at Attenborough; also recorded at Radcliffe, (Rev. J. Peach,) Highfield House, and Tollerton.

FAMILY IV., CARYCHIIDÆ.

GENUS CARYCHIUM.

Carychium minimum, very common.

It will be seen from the above list that the total number of species is ninety-nine.

[We commend the above list to the notice of working Naturalists, and shall be glad to receive any additions to it, or fresh localities for the rare species from other workers in the county. We should be glad, too, to publish similar lists of the shells of other counties. The best work by far on the subject is Dr. Gwyn Jeffrey's British Conchology, Vol. I., (sold separately,) Land and Freshwater Shells, Van Voorst, 10s. In this work 121 species are described as inhabiting the British Isles, so that the county of Nottingham appears to be well represented by the ninety-nine species above recorded.—Eds. M.N.]

EXAMINATION OF DRIFT.

RAILWAY CUTTING, NEAR WALSALL.

BY G. H. TWIGG.

On June 14th, 1879, some members of the Birmingham Natural History Society, on the suggestion of Dr. Deane, visited the above locality, and subsequently I have examined it upon two other occasions. The railway is intended for a loop line to connect the South Staffordshire Railway with the Grand Junction Line, and starts from a point near the level crossing over the former, about one mile south of Walsall Station, and proceeds in a south-westerly direction, joining the latter line near James Bridge Station, the total length not exceeding one mile. The cutting commences before reaching the main road from Walsall to Wednesbury, and it is in the section lying to the east of this road that the principal boulders have at present been found; those which I have personally examined occurred in a deposit of fine soft clay varying in colour from red to grey, and mixed up with beds of gravel. They are as follows:—

Fine-grained Basalt boulder	18″ × 16″ × 16″
" "	14″ diameter.
Decomposed " "	20″ "
" " "	24″ "
Partly decomposed " " with geodic cavities (similar to Toadstone)	12″ "
" " " but smaller cavities	28″ × 15″ × 15″
Carboniferous Sandstone boulder	30″ × 30″ × 15″
Red " "	12″ diameter.
" " "	8″ "
Carboniferous Sandstone (with plant remains)	14″ "
" " "	12″ "

The two boulders with geodic cavities appear to have one of their constituent minerals decomposed, the cavities now being filled with a pink mineral in which radiating marks are discernible; in the larger boulder this decomposition does not seem to have gone so far, for there are found on the face of a newly-fractured surface what appear to be green crystals, one point only of which is yet tinged with pink; but whether these are crystals of Augite or Olivine, or some other mineral, I have not been able to determine.

The cutting in this direction has not yet reached the turnpike road, but some hundred and fifty yards on the west side of the road other operations have been going on, and the cutting there exposes a deposit of quite a different character, the clay giving place to gravel, to which succeeds a considerable thickness of sharp white sand. Through this sand the cutting is not yet complete; but a little further on, at a point opposite to Bescot Hall, another cutting is being made, in which the deposit is distinctly stratified and has a dip of 8° north, the strike running in the same direction as the cutting, and along the banks the beds can be traced parallel and horizontal for some distance. The dip is shewn very distinctly

on the face at which the men are at work, and when last visited the beds occurred in the following order:—

Top soil and gravel..	9 feet.
Red sand, with thin seams of drift coal	18 inches.
Band drift coal	1 „
Grey sand	6 „
Gravel ..	4 „
Coarse sand ..	6 „
Gravel, with drift coal	4 „
Sand	7 „
Band drift coal ..	2 „
Fine sand	4 „
Gravel, with drift coal in large pieces ..	18 „

The beds of sand in this section thin out into the beds of gravel towards the south, so that the latter beds are some inches thicker on the north side than on the south side of the cutting.

The whole locality abounds in pebbles of igneous rocks, but by far the most abundant are those of quartzite, and many of these are from 6in. to 8in. diameter. Striated pebbles have not yet been found, nor do the boulders examined appear to have any striations; the underlying formations are the coal measures, and coal crops out in the immediate neighbourhood. The nearest localities for basalt are Pouk Hill (one and a half miles due north), and Rowley Hill (five miles south); and for quartzite, the Lickey Hills (twelve miles south).

These cuttings cannot fail to give instructive information to anyone making a careful examination, and this should be done at once by whoever desires to do so, as the line is being rapidly proceeded with, and the sides are smoothed down and the boulders cleared away as the work goes on, so that the aspect of the deposit is rapidly changed. Anyone, therefore, who is interested in the subject, and has opportunity to visit the spot frequently, would be enabled to report upon it more completely and to greater advantage; and I commend this locality, as one well worth reporting upon, to those who may be examining the drift deposits of the district.

THE AUDIOMETER.

BY WRIGHT WILSON, F.L.S., HON. SURGEON TO THE BIRMINGHAM AND MIDLAND COUNTIES EAR AND THROAT INFIRMARY, ETC.

Recently I had the pleasure of introducing this instrument to the notice of the Birmingham and Midland Institute Scientific Society. It is the latest outcome of those wonderful inventions—the telephone and microphone. The apparatus was contrived by Professor Hughes in the course of experiments made by him in electric induction, as recently described by him to the Royal Society. It consists of a battery, a microphone, two primary coils, a secondary coil, and a telephone. The secondary coil is movable on a boxwood bar; at one end is fixed the large primary coil, which contains 100 metres of insulated wire; at the other end is the small primary coil, having only six metres of wire. The secondary or induction coil has 100 metres of wire. The horizontal bar on which it slides is graduated into 200 parts; this is the reading scale

for hearing, and is divided into twenty centimetres, each of which is subdivided into ten, thus giving 200 units. The secondary coil depends entirely upon the current which is induced in it by the passage of a current through the primary coil, and is not in connection with the current from the battery. The telephone is in the circuit of the induced current, and has no other source of electricity. The microphone is nothing more than a small apparatus by means of which contact may be made or broken. For instance, a small electric bell, deprived of its bell, becomes a microphone in the sense in which it is applied to the audiometer.

The law from a knowledge of which this instrument was evolved is that a current passing through a wire will cause, within a certain distance, a current of an opposite character and direction in another wire placed near it. If a telephone is placed in the primary circuit, having a contact breaker or microphone in the same circuit, then every make or break sound will be heard in the telephone. Every time that contact is made or broken the secondary coil receives or loses an induced current, consequently the sounds produced by making and breaking contact are heard in the telephone, which is in the circuit made by the induced current. If, then, the secondary coil be steadily and slowly moved away from the large primary coil, the induced current becomes weaker and weaker, the sounds produced by the microphone or contact breaker become fainter and fainter, until the secondary coil arrives at a point called zero on the scale, where no sound can be heard at all. This is the place where the two primary coils exactly balance the secondary coil, which lies between them, and is also the average limit of hearing power in the healthy adult. Now, if the secondary coil be moved still further towards the lesser primary coil, the induced current begins to return, but is weaker than that which is induced by the larger primary coil.

By this instrument many morbid conditions, a knowledge of which is indispensable to a correct diagnosis, can be observed with an amount of certainty comparable to that derived from the use of a reliable thermometer in fevers. Throat deafness may now be diagnosed from deafness resulting from disease of the external ear, and the actual impairment ascertained. A chart may be kept of the daily progress of the case, and from it, in the course of time, valuable and reliable deductions will be made.

In examining patients with the audiometer many curious effects are noticeable. The power of hearing is found to differ in both ears in nearly all persons; it varies with the height of the barometer, with the amount of air in the lungs, with the temperature, and many other as yet ill understood causes. These causes will soon be classified, and then the future of deaf people will have a brighter look than it has ever had, and the treatment of their diseases must then assume a more definite position in the world of medical science. Besides the treatment of deafness this instrument is invaluable in all examinations of men's bodies for life insurance, the army, navy, telegraph service, railway servants, and others where good hearing as well as good sight is indispensable. By a slight modification the audiometer can be converted into an electro inductive balance, and becomes available for the analysis of metals; so delicate is it that it is said to have detected the 1,000th of a grain of silver in an alloy. Mr. W. R. Morris has exhibited this form of sonometer, as it ought to be called, to the society, when spurious coins were detected and the amount of waste due to wear and tear was shown upon the scale. It is difficult to say what uses this instrument will yet be put to, but it is clearly an exceedingly useful instrument for scientific research.

ON CARCHESIUM SPECTABILE.

BY H. E. FORREST.

Among the numerous, rare, and beautiful forms of animal life which were obtained from the Barnt Green Reservoir in such abundance last Autumn, by members of the Birmingham Natural History and Microscopical Society, was a species of Carchesium. I had the pleasure of spending several evenings with Mr. J. Levick in examining these rich gatherings, and both he and I noticed the wide difference between this and the common *Carchesium polypinum*, which also occurred in the same water. Since then I have received through Mr. Bolton a gathering of the same, made by Mr. Thompson, the secretary of the Microscopical Society of Liverpool. Mr. Bolton tells me he has also found it at the Hyde, near Stourbridge, and at the end of June, 1879, I found it again in the river Avon, at Evesham.

As *C. polypinum* was the only species of the genus with which I was acquainted, I thought, at first, that this was a new species; but as my knowledge of the literature of the subject was insufficient, I forwarded specimens to Mr. W. Saville Kent, of London, asking him if there was any described species which agreed with it. With great courtesy he sent me descriptions of no less than four species other than *C. polypinum*, and expressed his opinion that the one in question was *Carchesium spectabile*, an opinion which upon mature consideration I fully endorse. Mr. Kent writes that there is no good published figure, and that Ehrenberg's scanty and somewhat vague description seems to be all that is known of it. It is as follows: "Bodies conical-campanulate, dilated anteriorly; polypary two lines in height, forming an obliquely conical bush of considerable size."

This description is perfectly correct, but very meagre, and the following additional particulars will probably be found useful, as I feel sure that when once public attention has been called to it, it will prove to be quite a common species.

Carchesium spectabile grows in little tufts attached to weeds or roots in stagnant or slowly running water. The colonies are in the shape of a *solid* cone, while *C. polypinum* grows as a hollow cone. The bells are placed thickly together on the stalks, and when the cilia are in motion the rim is everted and dilated beyond the bell, but not so much as in *C. polypinum*. It is very sluggish in its habits, and its sensibility to irritation is so slight that in order to make it contract its pedicel it is necessary to tickle it with a bristle. This peculiarity may easily cause it to be mistaken for an Epistylis. It has a curious habit of investing itself all over with minute particles obtained from the surrounding water, and is often so entirely buried in this dirt as to be almost invisible. The cleanest specimens I have seen were those from the river Avon, but even they exhibited this tendency, though in a minor degree. Students of Infusoria are anxiously awaiting the issue of Mr. W. Saville Kent's work, in which this and the other known species will be well and amply figured.

Reviews.

A History of British Freshwater Fishes. By the Rev. W. HOUGHTON, M.A., F.L.S., Rector of Preston-on-the-Weald Moors, Wellington, Salop. In two handsome volumes, extra large 4to. Price (to subscribers only) £3 10s. Applications for copies should be made to the Author at the above address.

THIS work, being the production of an author in our own district, calls for special notice. Mr. Houghton is known to be an accomplished naturalist, and has already published several popular books on Natural History. The present volumes are of a more solid character. They contain a well-written description of every known British freshwater fish, illustrated by exquisitely coloured figures. Some of the *Salmonidæ* are figured for the first time. Each chapter is headed with a finely-engraved landscape, illustrating scenes dear to the angler. An introduction on the classification and structure of fishes is clearly written and copiously illustrated, the comparative anatomy of the several types being well displayed. The get-up of the work is really magnificent. It is at once the most complete monograph of this branch of natural history which has been published, and a most elegant ornament for the drawing-room table. The book is so good that we wish it were cheaper.

C. C.

Cardiff Naturalists' Society.—Report and Transactions for 1878.

THIS is the eleventh report of this large society, which includes 421 subscribing members. During the year fourteen lectures of a generally scientific nature were delivered, eight of which were given by local members, and the other six by professional scientists of high standing. The work of the sections of the society appears to depend (as in most of our local societies) upon a very few of the members. Mr. Franklin G. Evans furnishes an excellent detailed meteorological report; but the feature of the volume is the account by Messrs. T. H. Thomas and John Storrie, of the "Tridactyl Uniserial Ichnolites in the Trias, at Newton Nottage, near Porthcawl, Glamorganshire." This article, with its illustrations, may be considered as a continuation of the excellent series of detailed accounts of local geological features which have appeared in back volumes of the Cardiff Naturalists' Society, and which are chiefly due to the energy and love for thorough geological work of Mr. W. Adams, the founder of the society. The footprints described are five in number, and occur on a large slab of dolomitic conglomerate, *(Keuper,)* which has been removed to the Cardiff Museum. They are each about 9in. in length by 6in. in width, three-toed, and generally very similar to the footprints of *Brontozoum*, found so plentifully in the sandstones of Connecticut, also of triassic age. They also much resemble the tracks of the emu and cassowary of to-day. Such a discovery as this should lead dwellers in triassic districts to examine more closely the sandstone beds which are now so much neglected from the belief that they contain no organic remains.

W. J. H.

The Lichen-Flora of Great Britain, Ireland, and the Channel Islands. By the Rev. W. A. Leighton, B.A., &c. Third edition. Shrewsbury: For the Author. 1879.

We hail this book with pleasure as a valuable contribution to the Lichen literature of our country. It is now more than a quarter of a century since the Ray Society published a volume by the same author, "British Species of Angiocarpous Lichens," which was the first systematic attempt made to derive distinguishing specific characters from the spores, their form, size, and mode of septation. The present work being the result of the many years of subsequent close and careful application of the author to the study of Lichens may be accepted as the most complete, while it is the latest, British work on the subject. The branch of botany with which this deals is confessedly difficult, but the difficulty is much enhanced by the absence of useful handbooks like the present, and we look forward to a fresh impetus being given to the study in this country by its appearance. The Lichen-Flora of Great Britain, including the Channel Islands, comprises no less than 1,710 species, forms, and varieties. If we deduct from these the forms and varieties we have 1,133 species, which are distributed into 77 genera, and these again are arranged under 22 tribes, the whole forming four families, viz.: Byssacei, Collemacei, Myriangiacei, and Lichenacei. Three of the larger genera, *Lecanora*, *Lecidea*, and *Verrucaria*, comprise no less than 677 species, considerably more than one-half the whole Flora, but, by a very easy method based on the character of the spores, these genera are sub-divided in such a manner as very much to facilitate their study. The classification adopted is mainly that of Dr. W. Nylander, with such modifications as the author considered necessary, and we are glad to find that there is no great departure from that with which we are already familiar. A diagnosis of every species, the material on which it grows, its synonyms, references to plates when they exist, geographical distribution, as well as the distribution in Britain, according to Mr. Hewett Watson's well-known method, a specification of the exact habitats, with the names of those gentlemen on whose authority it is recorded, are given. The chemical reaction used so extensively by all leading Lichenologists is given in cases where it is obtained to assist in the determination of species. Some botanists smile at the adoption of this method of testing, as being chemistry and not botany, but we see little chance of its being abandoned so long as it serves to help with the other characters of a plant in the distinguishing of species. Mr. Leighton has wisely devoted a little more space in the introduction than was given in former editions to explain the method of applying the chemical tests, about which there should exist no uncertainty in the mind of the student, as serious errors may result from their misapplication. Another valuable addition is the microscopic measurements of the spores, taken from Mudd's "British Lichens," the writings of Dr. Nylander and Thos. M. Fries, supplemented with the author's own measurement. Those from the first-mentioned of these authors are the least reliable, and should in all cases be carefully tested by those of Nylander, Fries, and Leighton, which may be safely depended upon. A few points of much interest are touched upon briefly in the introduction, such as the morphology and physiology of Lichens, and the Schwendenerian theory of their parasitism on fungi, which we should have been pleased to have seen greatly extended. A list of authors cited, and published Exsiccati quoted, are given at the end, with a full glossary of terms and a copious index of species.

W. P.

Robert Dick, Geologist and Botanist. By Samuel Smiles. London: J. Murray.

On the last occasion when Mr. Smiles narrated the work of one of Scotland's humbler sons, to whom the name of working Naturalist could be fittingly applied—we refer to Thomas Edward—one could not but admire the manner in which the writer entered into his theme, and described with vivid clearness the struggles, successes, and disappointments which rendered the life of Edward so strikingly interesting. Consequently, it was with feelings of considerable expectation that we took up the life of Robert Dick, and after perusal we can cordially recommend it to the notice of such readers of the "Midland Naturalist" as have not already made themselves acquainted with it. The life of Dick may be briefly epitomised as follows: He was born among the lovely scenery of the Ochils in Scotland, at Tullibody, in 1811, his father being an officer of excise; his mother died when he was very young, and, as his father married again, the boy's home was rendered unpleasant to him by the unloving step-mother, who appeared to be jealous of any kindness paid to the children of the first marriage, so at the early age of thirteen Robert was apprenticed to a baker, and his life then was by no means of a romantic character; his work commenced at three in the morning, and he continued to drudge till seven, eight, and sometimes nine at night. The afternoons were his pleasant time, for then he had to deliver bread in the neighbouring villages, and it was on these walks that he began to take interest in Botany. At seventeen he left Tullibody to find work as a journeyman, and left it for the last time, as he was never able in his after life to spare money to visit it again. At the age of twenty he started for himself at Thurso, and here he remained all his life, at first succeeding well in trade, but eventually, through competition, scarcely making enough to supply himself with necessaries, but working hard till within a few days of his death.

The county of Caithness was at the time Dick went there a *terra incognita* to Naturalists; but, by his own unaided exertions, he made a complete collection of its flowers and ferns, his botanical reputation, however, resting mainly on his discovery of the *Hierochloe borealis*, or holy grass, a plant previously reported from Forfarshire by Don, but only on his own rather risky authority. Dick discovered this grass in several places on the River Thurso, growing on the boulder clay; besides this, he found *Osmunda regalis* and *Ajuga pyramidalis* in the county. Their discovery, although not reported till many years afterwards, brought a flood of correspondence upon the finder, and he distributed many specimens of the holy grass, of which the writer possesses one, which came through Mr. W. L. Notcutt—the gentleman whose list of Daventry plants in Northants is used by Watson in "Topographical Botany." Dick also gave Mr. Notcutt a splendid series of old red sandstone fossils; for Geology was taken up with ardent and unflagging interest by the Thurso baker, and it was principally by his aid that the geology of Caithness was made out; his discovery of shells in the boulder clay, and his supplying fossils of Diplopterus, Osteolepis, and Asterolepis to Hugh Miller laid science under great obligations to him.

Indeed, there was hardly a subject upon which Miller applied to him for information on which Dick did not give him invaluable aid. Agassiz and Sir Roderick Murchison testified to his claims on science, the latter again and again doing him homage. Among his most intimate friends was Charles Peach, born at Wansford, in Northamptonshire, and like himself an untiring labourer among the records of the rocks. Peach found fossil fishes in Cornwall, but eventually removed to Peterhead, where he added to the list of British fishes Yarrell's blenny, Ray's bream, and the anchovy, and then (he was in the Preventive service) came to Wick, when he and the baker became great friends. Dick pursued his researches with the greatest zeal, the principal part of his geological and botanical work being done between ten at night and eight in the morning, walking, as he says, sometimes fifty miles without sitting down, and with only a few biscuits to eat; and this not as an occasional thing, but repeatedly in order to visit a fern or search for traces of the boulder clay, or hammer out some fish from the rocky cliffs of Dunnet Head.

On laying down the book one cannot help regretting that with all the wealth of England a man like this could not have been provided with something to render the latter end of his life more comfortable.

The book is illustrated with some capital views, though the one of Wansford is not very good, and that of Morven exaggerates its height and steepness.

G. C. D.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF JUNE, 1879.

BY W. JEROME HARRISON, F.G.S.

June witnessed no improvement in the weather of this (atmospherically speaking) most disagreeable year. There were never two consecutive days without rain, which indeed fell on twenty-five days out of the thirty. Thunderstorms were frequent, and those of the 3rd, 8th, 9th, 12th, 24th, 25th, and 29th were general and severe; on the 11th there fell at Bishop's Castle 1·10 inches in twenty-five minutes! Temperature was greatly below the average, and there was little sunshine; Mr. Davis, of Orleton, writes:—"The mean temperature here of June is 3½° lower than the average; the rainfall has only once been exceeded (viz., in June, 1860) during the last forty-nine years. Up to the 1st of July this year the maximum of thermometer in shade has never reached 70°, this has not occurred for the last fifty-four years."

The barometer did not fluctuate much, but ranged somewhat low; light south-westerly winds prevailed, which gained, however, in intensity during the last week of the month. "Owing to the soaked and chilled condition of the soil, all garden crops, grass crops, and cereals have advanced nothing on the condition noticed last month, and are all a full month later than usual."—Rev. U. Smith, *Stoney Middleton.*

THE WEATHER OF JUNE, 1879.

STATION.	OBSERVER.	RAINFALL. Total for M. In.	Greatest fall in 24 hours. In.	Greatest fall in 24 hours. Date.	No. of rainy d.	TEMPERATURE. Greatest ht. Deg	Greatest ht. Date.	Great'st cold Deg	Great'st cold Date.
GLOUCESTERSHIRE.									
Cainscross, Stroud	W. B. Baker, Esq.	6·30	1·10	30	21	84·0	24 & 25	32·0	4
Cheltenham	R. Tyrer, Esq.	4·34	·92	30	26	68·8	13	35·2	4
Stroud	S. J. Coley, Esq.	4·38	·67	8	26	72·0	15	33·0	2
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	5·21	·99	11	25	69·0	14, 17, 20	37·0	2, 4, & 5
Woolstaston	Rev. E. D. Carr	6·13	1·07	7	26	69·0	17 & 19	39·0	2
More Rectory, Bishop's Castle	Rev. A. Male	6·47	1·35	11	25	72·0	18	37·0	5
Larden Hall, Much Wenlock	Miss F. R. Boughton	5·23			20				
Bishop's Castle	E. Griffiths, Esq.	6·14	1·43	11	22	69·0	5	37·0	5
Cardington	Rev. Wm. Elliott	6·06	1·08	7	25				
Stokesay	Rev. J. D. La Touche	6·71	1·15	7	26	68·0	5	32·6	5
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	7·84	1·00	12	25			28·0	2
Stoke Bliss	Rev. G. E. Alexander	5·92	·72	30	25	75·0	10	39·0	1
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq	6·00	·98	30	26	69·8	20	35·0	5
West Malvern	A. H. Hartland, Esq.	5·22	·82	16	24	70·5	20	36·5	1
Pedmore	E. B. Marten, Esq.	4·91	·90	30	27	81·0	16	41·0	3
Longlands, Stourbridge	J. Jeffries Esq.	4·74	·58	30	23	76·0	20 & 23	36·0	3
Dennis, Stourbridge	Mr. C. Webb	4·61	·62	16	25	69·5	5	36·0	4
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	4·28	·65	7	28				
Dudley	Mr. J. Fisher	4·48	·61	7	23	82·0	10	38·0	1 & 3
Sedgley	Mr. C. Beale	4·20	·63	7	25	68·0	20	41·0	1 & 5
Kinver	Rev. W. H. Bolton	4·1[illegible]	·69	7	23	74·0	14	37·0	4
Walsall	Mr. N. E. Best	5·21	·66	7	26	71·0	5	40·0	1
Grammar School, Burton	C. U. Tripp, Esq.	3·96	1·25	7	25	74·0	14	35·0	5
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	4·73	·71	7	27	77·0	20	36·0	5
Wrottesley	E. Simpson, Esq.	4·[illegible]0	·69	7	24	70·5	21 & 17	39·0	4
Heath House, Cheadle	J. C. Philips, Esq.	6·25	1·25	7	24	65·0	5 & 14	39·0	4 & 5
Alstonfield Vicarage	Rev. W. H. Purchas	7·89	1·14	30	23	70·0	17	31·0	5
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	5·92	·83	7	25	71·0	28	43·0	1, 3, & 4
Coventry	J. Gulson, Esq.	5·16	·92	7	24	71·0	28	38·0	2
Bickenhill Vicarage	J. Ward, Esq.	5·25	·78	30	26	68·0		47·0	
St. Mary's College	Rev. S. J Whitty	4·65	·74	7	24	67·9	20	39·1	2
Henley-in-Arden	T. H. G. Newton, Esq.	5·15	·72	30	26	70·0	5 & 15	37·0	2 & 5
Rugby School	Rev. T. N. Hutchinson	4·18	·81	7	24	69·0	14	39·4	5
DERBYSHIRE.									
Stoney Middleton	Rev. U. Smith	4·40	·81	11	20	66·0	17	25·0	4
Fernslope, Belper	J. G. Jackson, Esq.	6·05	·97	7	25	70·0	14,19&20	37·0	5
Brampton S. Thomas	Rev. J. M. Mello	5·53	1·24	7	19	68·0	20 & 28	33·0	5
Willersley Gardens	Jas. Tissington, Esq.	7·98	1·12	11	19				
Spondon	J. T. Barber, Esq.	5·25	1·26	11	22	65·3		35·0	2
Duffield	W. Bland, Esq.	6·48	·96	7	24				
NOTTINGHAMSHIRE.									
Hesley Hall	B. J. Whitaker, Esq.	3·89	·93	8	21	74·0	20	38·0	5
Tuxford	J. N. Dufty, Esq.	4·43	·81	7		81·0	24	41·0	3 & 4
Hodsock Priory, Worksop	H. Mellish, Esq.	3·12	·80	7	20	68·9	20	34·0	5
Highfield House, Nottingham	E. J. Lowe, Esq.	4·52	·74	7 & 8	25	72·2	17	37·3	5
Park Hill, Nottingham	H. F. Johnson, Esq.	4·97	·80	7	21	69·0	14	42·8	1
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	4·32	·88	7	22	70·7	14	35·1	5
Ashby Magna	Rev. E. Willes	4·78	·94	30	25	74·0	14	37·0	2 & 5
Market Harborough	S. W. Cox, Esq.	4·23	[illegible]	7	23	66·0	28	33·0	5
Kibworth	T Macaulay, Esq.	5·22	·84	7	25				
Town Museum, Leicester	W. J. Harrison, Esq.	4·34	·79	7 & 30	24	68·3	28	30·5	2 & 5
Belmont Villas, Leicester	H. Billson, Esq.	4·41	·82	30	26	71·5	5	29·5	1
Syston	J. Hames, jun., Esq.	4·06	·61	7	26	75·0	11	32·2	2
Waltham-le-Wold	E. Ball, Esq.	4·01	·68	7	23	69·0	10	38·0	3
Little Dalby Hall	G. Jones, Esq.	4·00	·64	7	22	79·0	28	32·0	5
Foxton Locks	Union Canal Company								
Coston Rectory, Melton	Rev. A. M. Rendell	4·19	·80	7	21	68·5	28	30·8	5
Belvoir Castle	W. Ingram	3·65	·75	8	25	71·0	21	33·0	5
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	5·47	1·58	7	24				
Castle Ashby	R. G. Scriven, Esq.	4·74	·72	26	23	72·0	14	41·0	3 & 4
Kettering	J. Wallis, Esq.	3·77	·69	7	21	70·0	15,20&21	41·0	4
Althorpe	G. S. Groom, Esq.	4·16	·99	7	24	70·0	14	36·0	1 & 4
Pitsford	C. A. Markham, Esq.	4·36	·90	7	25	75·0	5 & 14	36·0	2
RUTLAND.									
Burley-on-the-Hill	W. Temple, Esq.								
West Deyne, Uppingham	Rev. G. H. Mullins	4·39	·81	3	23	70·1	5	38·8	2
Northfields, Stamford	W. Hayes, Esq.	3·75	·74	7	19	74·0	7	34·0	5
Radcliffe Observatory, Oxford	H. E. Bellamy, Esq.	4·54	·50	30	28	68·1	28	40·4	3
Ventnor Hospital	W. T. Ryder, Esq.	4·34	·77	2	6	64·2	17 & 27	45·0	4 & 5
Altarnun Vicarage	Rev. G. Tripp	7·51	1·11	16	28	77·0	16	32·0	4

Natural History Notes by Observers.—*Highfield House Observatory, Nottingham.*—The following plants came into flower—1st, Azalea pontica; 2nd, Chestnut; 4th, Crowfoot; 5th, double White Narcissus; 11th, Rhododendrons, Lilac, Laburnum, and double White-thorn; 12th, Hawthorn; 21st, Snowball Tree; 26th, *Silene nutans* and Syringa. *Alstonfield Vicarage.*—Vegetation backward to a degree unknown to persons now living. *Veronica Chamædrys* only began to flower June 2nd. The Ash tree is scarcely in full leaf June 30th. The fruit of the Wych Elm only just now falling, June 30th. Hawthorn not fairly in flower until 26th. A flight of the Painted Lady Butterfly began to appear on the 12th, some of the specimens seemed hybernated. *Cheltenham.*—First Strawberry picked 29th, Currants just ripening 30th. *Kibworth.*—Hawthorn, fl. 8th. *Shifnal.*—Farmers on strong soils could not get in their swedes or cut their hay till the close. No butterflies except a few White and Orange Tip. Ash only bursting into leaf on 5th. Apples, of which there was a great show, all falling off. Not a rose in blossom except on the wall. *Bishop's Castle.*—No harvest commenced yet (July 4th), and grass beginning to rot at the roots. *Chesterfield.*—Hawthorn, fl. second week in month. *Burton-on-Trent.*—First Hawthorn, fl. on 5th, in general bloom on 12th; Horse Chestnut, fl. 6th; *Geranium molle*, fl. 7th; Guelder Rose, fl. 30th. *Stroud.*—*Veronica arvensis*, fl. 5th; Hawthorn, 8th; *Papaver Rhœas*, *Iris Pseudacorus*, *Aquilegia vulgaris*, *Scrophularia nodosa*, *Bunium flexuosum*, *Thymus Serpyllum*, *Potentilla nemoralis*, *Vicia sativa*, *Onobrychis sativa*, *Arabis hirsuta*, *Linum catharticum*, *Anthyllis vulneraria*, *Lotus corniculatus*, fl. 19th; *Rosa canina*, fl. 21st; *Lychnis dioica*, *L. flos-cuculi*, *Fumaria officinalis*, fl 23rd; *Lathyrus pratensis*, *Hippocrepis comosa*, fl, 26th; *Atropa Belladonna*, *Sambucus nigra*, fl. 30th.

Correspondence.

Vanessa Cardui is this season much more numerous than usual. A good many have already been caught. It is generally rather uncommon just here.—O. V. Aplin, Bodicote, Oxon, July 3rd, 1879.

Acronycta alni, near Nottingham (from the *Entomologist.*)—The larva of the rare *Acronycta alni*, which Mr. Watchorn found at Cotgrave, in August last, came out on Tuesday, June 3rd, a perfect imago, and was exhibited at this Society's Room on Monday, June 9th.—J. Brooks, Hon. Sec. Nottingham Working Men's Naturalists' Society.

The Bee-eater in Derbyshire.—The note at page 188 of the occurrence of the Bee-eater in this county is very interesting. But if the writer would kindly tell us the precise locality of the specimen, whether male or female, whether any others were killed or seen, whether it bore any marks of captivity, by whom it was killed, and its destination, and any other particulars he may be able to give, the value of the note to future writers on the Ornithology of the county would be immensely increased.—Merlin, Derby, 17th July, 1879.

Ornithological Notes.—A correspondent in the "Midland Naturalist" for last month asks about Thrush's eggs without markings. A few years ago I found a nest of *T. musicus* containing four or five eggs, (I do not remember which,) two of which had the markings of a pale brown, in the others they were entirely wanting. The Spotted Flycatcher was observed here on the 21st, Corncrake on the 22nd, Whinchat (rare just here) on the 24th May, Turtledove June 18th, (doubtless this arrived before,) and Nightjar (rare) June the 27th. The Cuckoo was still in full

song here on the 4th of this month. This is not in accordance with "in June he changes his tune." Rooks were very irregular in hatching this season. I heard young calling from the nests from April 16th till June 2nd. I was told of a fine male Cirl Bunting observed at Chinnor, a few miles from Thame, in this county, on the 13th inst.; it was not at all shy, and allowed my informant to get within a yard or two of it. Allow me to assure Mr. Macaulay that I am *not* offended with his assertion with regard to the Wryneck; if he will refer to my notes in the June number, he will see that I was aware I had not made it a *certainty*. About ten years ago, two, a pair probably, of Great Grey Shrikes were killed near Hook Norton, about eight miles from here, at the end of March or beginning of April, (March that year being very warm.) One is in the possession of Mr. J. Gardner, of Warwick, who had them both in the flesh, and who kindly furnished me with the particulars. I fancy this was rather late for them to be here, considering it was a mild spring; and it seems as if they might possibly have bred in the neighbourhood had they been left.—O. V. Aplin, Bodicote, Oxon, July 19th, 1879.

Ornithological Notes.—The migrant season being over, I have very little to communicate. In my last notes "*common* flycatcher" should be "*pied* flycatcher." A Greater Tit, *Parus major*, built her nest in a strange place—a letter box. The box is about eighteen inches deep, and the opening for letters at the top, in front, 3½in. wide by 1in. deep, and through this the parent birds conveyed the necessary materials for the nest. The nest was built on the bottom of the box, and during the building, laying, sitting, and rearing and feeding the young brood, the box was daily used by the postman, every letter and paper being dropped into the slit above and falling on to the young birds, or on to the parent sitting, yet no notice was taken of the disturbance. The box had an opening, falling outwards on a level with the nest, and through this the letters, &c., were daily removed without any apparent notice on the part of the old bird, who often remained on the nest during the operation. On one occasion, I visited the nest a few days after the young were hatched, and opening the flap, not only inspected the bird on the nest, but first stroked her gently with my hand, and then finally lifted her off the nest and released her, which she allowed me to do without manifesting the slightest fear. I have in my collection two Thrush's eggs, taken this year, no larger than a Redbreast's. I have also seen this season two eggs of the same bird, curious as a variety. The ground colour is a lighter blue than usual, and the spots are reddish brown instead of black, much the same in colour as the Missel Thrush's. I do not know whether this variety is common or not, but I have not met with it before. The Nightingale was last heard here on the 24th June.—T. Macaulay, M.R.C.S.L., &c., Kibworth.

Sea-birds in Birmingham.—The unsettled weather of late has brought under the observation of Mr. W. Wyatt, of the Edgbaston Reservoir, the following sea-birds:—*Larus canus*, L., two or three; *Larus*, (species uncertain,) immature; *Sterna fluviatilis*, (Naum.,) or *Sterna macrura*, (Naum.,) two; and one *Colymbus septentrionalis*, Lath., immature. As usual, one or two Grebes, *Podiceps cristatus*, L., visited the pool, but, though not interfered with, did not remain for long.—Montagu Browne, F.Z.S.

Black Band in the Drift.—(See *ante*, p. 189.) This deposit should be carefully examined: it may agree with the black implement-bearing bed at West Stow, Bury St. Edmunds, in which vegetable remains, fine bones, hairs, &c., are found in association with implements and flakes of Palæolithic age. Flint-flakes should be looked for, and the material of the black band carefully examined under the microscope.—W. G. Smith, 125, Grosvenor Road, Canonbury, London, N.

BEMBIDIUM ADUSTUM, *Schaum*, (RUPESTRE, *Dawson*,) IN THE MIDLANDS. —It is with great pleasure that I record the capture of this extremely rare beetle, which I have found in some numbers on a very small spot of ground in the neighbourhood of Tewkesbury. Until re-discovered by myself, only a very few indigenous examples were known. These were originally in the Stephensian cabinet; were said to have been found at Swansea, and upon them Dawson founded his description of *B. rupestre*, with which the Tewkesbury beetle perfectly agrees. Mr. E. C. Rye, to whom I sent specimens, endorses my insect as *adustum*, and warmly congratulates me on its capture.—W. G. BLATCH, Green Lane, near Birmingham, 22nd July, 1879.

REGISTER SHOWING THE DATES during the last fifteen years on which Wheat-ears were first seen in the neighbourhood of Kettering:—

	Rainfall to 30th June each year.
1865, June 5th	10·50 inches.
1866, " 12th	10·31 "
1867, " 9th	10·97 "
1868, May 30th	7·96 "
1869, June 9th	12·19 "
1870, " 9th	5·36 "
1871, " 16th	8·29 "
1872, " 15th	14·99 "
1873, " 14th	9·51 "
1874, " 2nd	7·26 "
1875, " 4th	8·57 "
1876, " 16th	12·39 "
1877, " 16th	11·16 "
1878, " 11th	12·83 "
1879, July 1st	15·51 "

JOHN WALLIS.

INSTINCT OR REASON?—The instinct by which quadrupeds will sometimes find their way is quite as difficult to understand as that which teaches the bird to find his path through the air. When we removed from Coventry to our Stoke cottage, on the 7th May, our town cat accompanied the family. She travelled inside the brougham in a close hamper, and could see nothing beyond her basket. On her first arrival at Stoke, puss looked wildly about her and could not understand the change; but after a full inspection of the premises from the cellar to the roof, and the surroundings of the house, she settled down, apparently delighted with the pleasures of country life, and spent a fortnight very happily. Then suddenly she took it into her head to re-visit her friends in Priory Row, where, on my arrival on the 23rd, I found her, having trotted two miles by field or road she never could have seen, and about three-quarters of a mile of it through the intricate streets of Coventry. The sight of birds has been proved to be excessively long and keen, and it seems to be proved that the vultures and other birds of prey discover their food by sight, and not at all by scent; but the cat, which creeps along the ground, cannot get a bird's-eye view from any great height. How she can take her bearings and steer across an unknown country is one of the mysteries of instinct.—JOHN GULSON, Coventry.

[We should be glad to be favoured with any good, unpublished instances of remarkable sagacity or "instinct" on the part of animals, which may come within the knowledge of any of our readers.—EDS. M. N.]

Gleanings.

MIDLAND UNION.—The Bedfordshire Natural History Society and Field Club has joined the Midland Union of Natural History Societies.

THE BOOK CIRCULAR of Natural History and Scientific books, just issued by Mr. Wesley, 28, Essex Street, Strand, London, is devoted to Ethnology, Botany, Conchology, Entomology, Ornithology, &c.

NEW ORNITHOLOGICAL SOCIETY.—An association, to be called the "Willughby Society," has been founded for the purpose of reprinting scarce ornithological works, commencing with Tunstall's "Ornithologia Britannica." The annual subscription is £1, and Mr. F. D. Godman, 10, Chandos Street, Cavendish Square, London, is the secretary.

MICROSCOPE FOR PETROLOGY.—Mr. Swift, the well-known optician, has lately supplied to the Science and Art Department a number of microscopes constructed after designs furnished by Professor Judd, specially for the purpose of examining rocks. The instrument is of strong and simple construction; it has a 1½inch objective and a coarse adjustment only, but the latter works with the greatest smoothness. The stage is of black glass, rotating, with a divided circle. The polariser is fixed below the stage by an attachment which enables it to be thrown in or out of position by a touch of the finger; the analyser is placed in the body tube, immediately above the objective, and is manipulated with equal facility. We can testify to the excellence of the workmanship and to the convenience of the instrument for the purpose for which it has been designed. Its price is, we believe, £8. With the addition of a micrometer eye-piece, a quarter-inch objective, and a double nose-piece, it would form perhaps the best cheap working instrument for general scientific purposes with which we are acquainted.

FRESHWATER LIFE.—Mr. Bolton, 17, Ann Street, Birmingham, informs us in continuation of his report, (pp. 97, 127, and 162,) that he has sent the following additional objects to his subscribers:—*Brachionus pala* and *B. urceolaris*; *Uroglena volvox*; the "Glass" Larva of *Corethra plumicornis*; a very rich gathering of rotifers, including *Asplanchna Brightwellii*, *Triarthra longiseta*, *Synchæta mordax*, *Polyarthra platyptera*, *Rhynops vitrea*, and *Anuræa aculeata*; some leaves of *Myriophyllum spicatum*, literally covered with *Floscularia cornuta*, and other rotifers, infusoria, desmids, and diatoms; *Gonium pectorale*, and *Nostoc commune*. All these were sent out with admirable drawings and short descriptions. Mr. Bolton joined (by invitation) the marine excursion of the Birmingham Natural History and Microscopical Society in charge of the microscopes and apparatus, and took advantage of his visit to Falmouth to send out to his subscribers specimens of the beautiful Discophora, *Lucernaria auricula*, with a drawing from life by W. P. Marshall, C.E., and description by Professor Huxley. Mr. Bolton has now issued a portfolio of drawings and descriptions of Pond-life Organisms, (1s. post free,) which will be very useful to students. Mr. T. J. Slatter (on seeing Mr. Bolton's report, p. 162) writes, on June 2nd, that he had also found a new habitat for *Melicerta tubicolaria*, and that he had a flourishing colony on *Nitella* in the aquarium in his drawing-room.

SYMONS' BRITISH RAINFALL FOR 1878.—This volume furnishes another proof of the untiring industry and minute accuracy of its editor. Probably in no other country would it be possible for such an organisation to be established and controlled by a single private individual. Here we have

some 2,000 observers in all parts of the British Isles recording with care, and by means of accurate instruments, the principal meteorological phenomena—especially rainfall; while in Mr. Symons they have a leader who is ever ready and competent to give advice, and by whose keen eye every return is checked, whilst by his collation, preparation, and publication of the results obtained most valuable data are made known, and the observers are encouraged to perseverance and regularity. From p. 105 we quote the following as the average rainfall for each of the three kingdoms in 1878:—

England	.. ..	38·28 inches.
Scotland	.. ..	31·46 „
Ireland	.. ..	32·56 „

and Mr. Symons' summing up on these figures is, "in England and Wales an average fall, in Scotland and Ireland rather a deficiency, but not extreme in any part." The above is, however, the result of the average of the few stations on Mr. Symons' list where continuous observations have been carried on since 1850, and we can nowhere discover what is the average rainfall for 1878 when the returns from the whole of the recording stations are taken into account; nor can we find the average fall in each of the twenty-three "divisions" which Mr. Symons establishes for the British Isles. These figures if they could be given would, we think, be of considerable interest and importance. Finally, we may extract the "extremes of rainfall in 1878:"—

Largest rainfall at The Stye, Cumberland	.. ..	149·04 inches.
Least rainfall at Keadby, Lincolnshire	.. ..	17·35 „

Ray and Palæontographical Societies.—We are requested to state that the Local Secretary has received from the Rev. Thomas Wiltshire, the London Secretary, a small parcel of 8vo. lithographs of the curious appropriate *menu* designed by E. W. Cooke, Esq., R.A., F.R.S., for the anniversary dinner of these societies, held in 1877, and that he will be happy to forward (to the extent of the supply) a copy to any member of the "Midland Union" on receipt of a halfpenny wrapper or large-sized stamped envelope, addressed W. R. Hughes, 23, Union Street, Birmingham.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—Geological Section.—June 24th. Mr. Waller showed a spike of *Cotyledon umbilicus*, from near Penzance, 30in. in length. It had also several supplementary spikes growing from the principal one.—Mr. Levick showed *Volvox globator*, *Paludicella Ehrenbergii*, *Alcyonella fungosa*, and an Amphileptus which he has been unable to identify with any recorded species.—Mr. Morley gave some particulars as to the arrangements for the marine excursion. He also showed some nature-printed British ferns, including varieties of *Scolopendrium vulgare*, *Polystichum angulare*, *Blechnum boreale*, and *Athyrium Filix fœmina*. In the discussion which arose Mr. Hughes gave an account of an observation on a specimen of *Ophioglossum vulgatum*, in Mr. H. Allport's collection, which showed that the fronds are thrown up from a creeping subterraneous rhizome, and are not solitary as usually they apparently are.—Mr. Southall reported that the cutting in the drift gravel, near Walsall, was visited on the 14th June, and specimens obtained of the included rocks. July 1st.—General Meeting.—Mr. A. W. Wills exhibited a freshwater alga belonging to the Oscillatoriaceæ, genus Spirulina.—Mr. J. Levick exhibited

Hydatina brachionus, a beautiful free-swimming Rotifer.—Mr. J. E. Bagnall exhibited, on behalf of Mr. T. J. Slatter, *Lathyrus Aphaca*, in flower, from Evesham; also, on behalf of Mr. J. W. Cotton, *Habenaria chlorantha*, *Melampyrum pratense*, *Vicia Orobus*, and *Orchis conopsea*, all from Barmouth. Mr. W. R. Hughes exhibited the skins of two moles found dead on his grassplot at Handsworth, and a short discussion followed as to the possibility of their having killed each other. Mr. H. E. Forrest exhibited a rare infusorian, *Carchesium spectabile*, (of which an account is given on page 204,) and read a letter from Mr. W. Saville Kent relating to it. July 8th.—BIOLOGICAL SECTION.—Mr. H. E. Forrest exhibited *Trichodina pediculus*, a pretty little infusorian, shaped like a kettle-drum, with a circle of cilia at both the upper and lower edges. It is parasitic on Hydra. Mr. Barratt shewed tadpoles of frog in various stages of development, from the appearance of the hind legs to the atrophy of the tail. Mr. W. G. Blatch exhibited *Pterostichus lepidus* and *Cymindis vaporariorum*, two coleopterous insects new to the district, found at Cannock Chase; also a new and improved form of collecting bottle devised by himself. July 15th.—MICROSCOPICAL GENERAL MEETING.—Mr. W. Wright-Wilson, F.L.S., exhibited a duck affected with a nervous disease, preventing it from performing any co-ordinated movements, due possibly to the presence of a cystic worm pressing upon the cerebellum. Mr. Montagu Browne, F.Z.S., exhibited *Acronycta alni*, the alder moth, very rare in this district. Mr. W. R. Hughes, F.L.S., then gave a very interesting preliminary account of the recent marine excursion to Falmouth. He said that scientifically it had been the most successful of the four marine excursions; the dredging, having been carried on in fifty fathom water, had resulted in many rare and interesting forms of animal life. On the present occasion he confined himself to noticing the living specimens only, which had reached Birmingham, the preserved ones being reserved until they had been more thoroughly examined.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY. —June 28th.—EXCURSION TO DUDLEY AND DISTRICT.—On arrival at Dudley the party walked through the Castle Grounds to the Foxyards open workings, to see the outcrop of the thick coal; the coal in the workings being obtained direct from the surface, and worked as a quarry to a depth of twelve yards. The bed of ironstone which overlies the coal at the east end of the quarry was next examined, and in the nodules numerous specimens, containing plant remains, were found. The party then walked along the south-west flank of the Wren's Nest Hill, and secured some characteristic Silurian fossils. Passing under the hill through the tunnel, the visitors were charmed with the picturesque view which presents itself on emerging into the daylight caverns on the other flank. The party then re-entered the Castle Grounds, took tea at the Lodge, and returned to Birmingham about nine, having thoroughly enjoyed the afternoon. July 19th.—An excursion was made to California Clay Pits, Weoley Castle Quarry, and the Permian Breccia at Northfield.

BEDFORDSHIRE NATURAL HISTORY SOCIETY.—June 26th.—At the monthly microscopical meeting, (Mr. G. Hurst, F.S.S., presiding,) the Mayor of Bedford, Mr. T. G. Elger, F.R.A.S., Hon. Sec., read the first part of a paper on "The Micro-spectroscope." Having described the corpuscular and undulatory or wave theories, Mr. Elger next detailed very strikingly some of the more noticeable phenomena of light. He then explained, illustrating his remarks by diagrams, the construction of the micro-spectroscope and its adaptation to the microscope. He pointed out that the absorption observed in objects examined by means of it is caused by the peculiar molecular structure of the various substances, which refuses to allow light of certain colours to pass, and hence causes dark bands and lines to appear in those parts of their spectra where the absorption occurs. He showed examples of absorption in a variety of substances, solid and fluid. Among the former he exhibited the absorption which takes place in glass of various colours, in films of gelatine coloured with aniline dyes, &c., and among the latter the spectra of chlorophyll and of other preparations from plants of different kinds. The concluding portion of the paper is to be given in October. A hearty vote of thanks was unanimously accorded to Mr. Elger.

CARADOC FIELD CLUB.—The first Field Meeting was held on Wednesday, June 25th, at Buildwas. Visited Benthall Edge. Address by G. Maw, Esq., on "Glacial Drift in the neighbourhood." After luncheon at Benthall Hall, and examining Mr. Maw's valuable collection of Alpine plants, &c., to Lincoln Hill Lime Caverns and Buildwas Abbey, with paper on latter by F. Rawdon Smith, Esq.

NORTHAMPTON NATURAL HISTORY SOCIETY.—June 16th.—It was resolved to publish a quarterly journal for the society, each number to contain a photograph of one of the trees of the county, with description and measurements, or other object chosen by the committee; papers read before the society reports of the meetings; a diary of occurrences in natural history; meteorological report, &c. An editing committee was appointed.

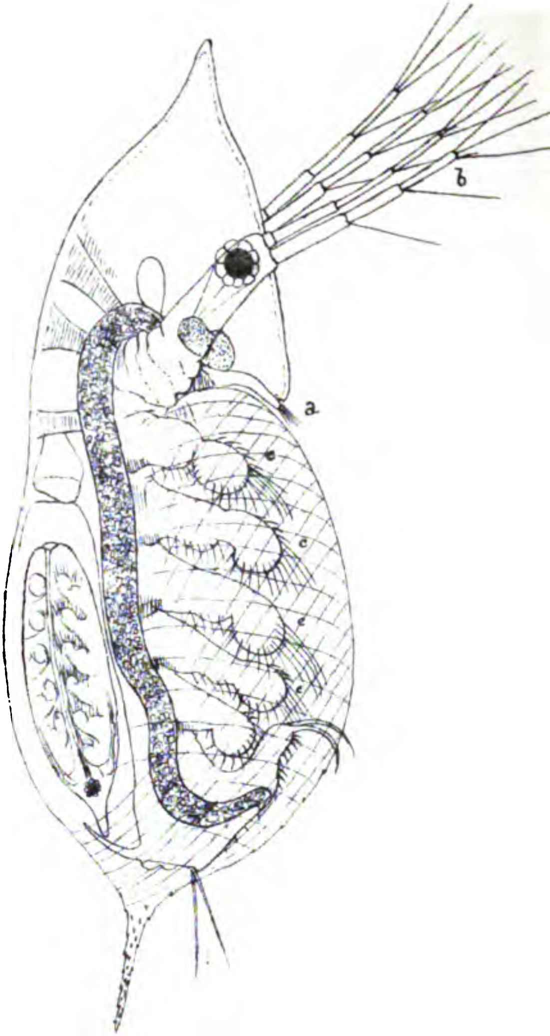
SEVERN VALLEY NATURALISTS' FIELD CLUB.—The Severn Valley Naturalists' Field Club visited Ludlow and neighbourhood on Thursday, July 17th. Carriages met the party at Ludlow Station, the drive being first to Oakley, where the party alighted and walked through the park up the valley of the Teme and on through the Downton Walks to the Hay Mill and Brow Bridge. Near this last named point the carriages took up the party for the return drive to Ludlow, *via* Burrington and Mary Knoll. This district is "classic ground" to the geologist, and under the guidance of the Rev. J. D. La Touche and Theophilus Salwey, Esq., the party were able to examine many points of geological interest. Proceeding from the old Red Tilestoues, the passage beds were examined in the section at Tin Mill. Before reaching Forge Bridge the Downton sandstone was seen finely developed. At Forge Bridge the celebrated bone bed was found, and specimens were obtained from it, as also at another point in the walk. In the Downton Walks the upper Ludlow rock was reached, this being finely exposed as far as Hay Mill. At Bow Bridge the Aymestry limestone is finely developed in a perpendicular escarpment 60ft. to 70ft. in height. Mr. Theophilus Salwey read an interesting paper on the points of geological and archæological interest in the district. During the return drive the escarpments formed by the Wenlock and Aymestry limestones to the right and to the left of the road afforded a striking illustration of the result of the action of denudating forces upon an originally perfect dome of these strata. Till within the last hour of the drive, when a heavy shower fell, the day was fine and warm, and the excursion through the lovely valley of the Teme afforded a most enjoyable day to the party, which consisted of thirty-eight members and friends of the club. Time did not suffice for a visit to the church, castle, and museum at Ludlow.

STROUD NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.—July 3rd.—This was the annual field day of this society, and Chedworth the place fixed for the excursion. Mr. E. Witchell, F.G.S., president, Mr. C. Playne, ex-president, and thirteen other members formed the party. They travelled from Stroud to Cheltenham by train, where a break and horses were in readiness, by which they were conveyed through a beautiful and interesting country to the Roman Villa, at Chedworth. The villa is situated on the line of the Roman Fosse Way, and diverges from the Roman Road known as Icknield Street leading to Oxford. It was discovered about the year 1866 on property belonging to the Earl of Eldon, who spent a considerable sum of money in its excavation, and also in erecting a museum and necessary covering for the remains. The discovery is said to have been made by a Mr. Farrer, whose attention was called to it in consequence of some tesselated pavement having been brought to light in digging out a ferret that had buried itself in a coppice wood, which at that time covered the remains. The villa proper forms three sides of a square, and the few buildings on the south side appear to have been offices or servants' apartments. The President read several extracts from the Rev. S. Lyson's paper to the Cotteswold Club, giving an interesting account of the neighbourhood. The party returned by way of Puesdown and Andoversford.

EXCHANGE.

Coleoptera.—*Silpha littoralis*, from Bewdley Forest, for local Coleoptera or Lepidoptera.—F. B. Taylor, 36, Chapman Road, Small Heath, Birmingham.

Plate IV.



H. E. Forrest, del.

Daphnia Bairdii.

ON A NEW ENTOMOSTRACON.

BY H. E. FORREST.

A short time ago Mr. Thomas Bolton sent me some water from Olton Reservoir, containing, amongst other things, a curious Entomostracon, which he wished me to examine and draw. At the first glance I saw that it was a form new to me, and forthwith set about drawing it. That done, the next thing was to find out its name, but vainly did I search through and through Baird's "Entomostraca"—it was not there. All that could be discovered about it was that it belonged to the Entomostraca, order Cladocera, family Daphniadæ, and genus Daphnia. Baird describes seven species, viz., *Pulex*, *Psittacea*, *Vetula*, *Schæfferi*, *Reticulata*, *Rotunda*, and *Mucronata*, but the one in question was none of these, and I have therefore the pleasure of describing it as a new species, unless it has already been described in some other work unknown to me. Every Naturalist, and especially every student of Entomostraca, will feel that it is but a just and graceful tribute to the name of one who did so much good work for science at a time when very little was known of these little creatures, if this new species be dedicated to Dr. W. Baird, the author of "The Natural History of the British Entomostraca," especially as no other animal is so named. I therefore christen it *Daphnia Bairdii*, if it has not yet received any other name.

The appearance of *Daphnia Bairdii* in the microscope is irresistibly comic. It has an immense head which terminates upwards in a sharp point, exactly as if it were wearing a "dunce's cap," and in this its one goggle eye rolls about with an air of supernatural wisdom. Its body is transparent and almost colourless. It has the following characters in common with the seven other members of the same genus:—Head produced downwards into a prominent beak, from the base of which spring the two very small, one-jointed, superior antennæ (*a*.) The inferior antennæ (*b*) are large and powerful, two-branched, one branch three-jointed and bearing five setæ, the other branch four-jointed and bearing four setæ. It has five pairs of feet (*c*) all enclosed within the carapace. The following characters distinguish it from its congeners:—The valves of the carapace or shell are oval, transparent, nearly colourless, and the surface is marked with striæ crossing each other obliquely. These markings are not nearly so apparent as in the other Daphniæ. The head is very large (larger than in any other species) and almost an equilateral triangle. The lower extremity of the valves terminates in a long, sharp spine, which is finely serrated; the edges of the valves, too, are sparsely serrated to about half-way up. Length from top of head to extremity of spine, 1-20in. The individual drawn on Plate IV. is an adult female, and has within her carapace and behind her body a young one, almost ready to issue forth. This young one is seen edgeways, and it will be noticed that the triangular head is not rounded but flattened at the sides, like an admiral's cocked hat. In young specimens the body is more rotund than in the adult, and the top of the head is not nearly so sharply pointed. *Daphnia Bairdii* does not appear to be very prolific, as I never saw more than two eggs in one female. The male I have not yet seen, though I have searched for it, and hope to obtain it eventually. Anyone desirous of seeing living specimens of this interesting animal can obtain them from Mr. T. Bolton, 17, Ann Street, Birmingham.

ON THE MEASUREMENT OF THE SEDIMENTARY DISCHARGE OF RIVERS.

BY THE REV. J. D. LA TOUCHE.

I propose in this paper to give a short account of some experiments which were made a few years ago with the object of estimating the quantity of sedimentary matter carried down annually by the waters of the Onny, a small stream in Shropshire. Unfortunately, at the very time when the arrangements for making these observations were matured and about to bear fruit, it was found impracticable to carry them further, since just then an extensive scheme of irrigation was started by an enterprising landlord, which involved the withdrawal at occasional intervals of large volumes of water from the stream, and thus my plans and methods of measurement were utterly disconcerted. Possibly others may be more favourably circumstanced; and I now record the results of my experiences in the hope that they may thereby be helped to pursue an investigation which requires but the simplest apparatus to carry it on, and which can hardly fail to lead to very interesting and important results. That such was the opinion of Sir Charles Lyell was shown by the energy with which he supported and encouraged my attempt, and advocated and succeeded in obtaining from the British Association a grant of money in two successive years to defray the expenses incurred in its prosecution.

Every one must be struck by the condition of a river in full flood. The water, at other times quite clear, is then loaded with sediment; this sediment is an exact measure of the work done by atmospheric influences carried on over the whole area drained by that river. Starting from the rocky ridges which generally crown the water sheds and higher lands, all along the slopes of hills and through the undulations of the surface, down to the valleys at the bottom of which flows the stream that carries off the water which falls on the whole area, a slow, but ceaseless, and mighty atmospheric action is for ever grinding up the hardest materials and reducing the rocks, through the successive stages of greater and lesser fragments, stones, pebbles, gravel, sand, and lastly, soil, to an impalpable powder, which floats readily in the water of the river for a sufficient time to permit its transportation over many miles on its way to the sea.

Here, as everywhere else in creation, the law of eternal change is maintained. Continents and all that is erected on them are swept away and give place to other continents to be built up out of their materials. What, however, we are now concerned in, is the fact that the measurement of this mud furnishes a proximate means of calculating the rate of geologic change; and, if we could eliminate the errors which attend the computation, would help us to correct those vague and unsatisfactory statements in which the words "millions and billions of years" figure so freely, exciting, I fear, the not altogether unmerited incredulity of the unscientific. It is evident that if we could form any reliable estimate of the number of cubic yards of solid rock which in the form of mud are

carried down annually by a stream and divide this into the cubical contents of the basin excavated by its action, we should have as a quotient the number of years the operation took to accomplish. Of course many disturbing elements enter into the calculation to complicate it and render it more or less uncertain; and these must not be lost sight of. It may be that the average rainfall of past ages was very different from the present, or that climate had a different effect in modifying atmospheric action. Still, as a step towards removing our difficulty in the way of cyclic computation, to estimate the sedimentary contents of rivers is a problem of considerable importance.

The elements required for this calculation are, the quantity of water passing a certain spot in a given time, and the quantity of sediment in a given bulk of such water.

The mode I adopted to ascertain the first was as follows. Having chosen a reach of the river as straight and as free from obstructions as possible, I erected a post, painted white, and divided into feet and decimals of a foot, zero corresponding with summer level. By this was registered from time to time the height of the river. Along the bank a space of one hundred feet was measured off and three cross sections made, one at each end and the other in the middle of the measured space. From these it was easy to construct a mean section. When it was desired to note the volume of discharge, the speed of the surface was ascertained by throwing in small pieces of wood and marking the time that elapsed while they passed the measured hundred feet. Then by the use of certain tables, to be found in Neville's work on hydraulics, it was possible to arrive at the mean quantity of water that passed this spot per minute. It is necessary previously to construct a table from the data furnished by the average cross section, which gives the wetted surface of the river bed for each decimal mark on the gauge.

So much for the volume of water. The amount of sedimentary deposit held in suspension was determined by taking at intervals of the flood measured bottles of water, then allowing the mud to subside, which it sometimes required two or three days to do completely, decanting off the clear liquid, carefully drying the residuum on weighed filter paper, and afterwards weighing the whole in a balance which indicates correctly to the 50th of a grain. The solid matter contained in a given quantity of water was thus determined, and the remaining calculation was easy.

The object of registering the height of the stream on the post or gauge is to save the necessity of repeated observations on its velocity. The speed varies, of course, with the height, but is constant at any particular height. I found that by ruling a sheet of paper with lines at right angles and at equal intervals, thus covering it with a number of small squares, the divisions in one direction expressing equal heights on the gauge, and those in the other the speed of the stream measured in seconds and feet, and marking on these lines a number of observations, the curve of a rectangular hyperbola was traced, which enabled me to construct a table giving the mean volume of water proximately at any time when an observation had been missed, when, as during the darkness of the night, it would have been impossible to make it.

In the foregoing observations I had to rely on the accuracy of Neville's tables. I have, however, reason to believe that much has yet to be learned as to the discharge of rivers. The state of the bed, as well as its average inclination, materially affect the rate of the current, and must modify each case. In the portion, too, of the Onny which I selected I found afterwards that a mill sluice, which was sometimes open and sometimes closed, destroyed the value of much of my work. Many places, however, might be selected in which these sources of error do not exist, or in which they might be reduced to a minimum.

The following, taken from the record of my observations, may help to illustrate what has been said. The rainfall is taken from an average of four rain gauges situated in different parts of the basin of the Onny, an area of about eighty-four square miles.

Date.	Hour of Day.	Height on gauge.	Grains in 100 oz. of Water.	Discharge of sediment per minute, in lbs.	Rainfall.
1870.					
March 1st					·54
" 2nd	10 A.M.	·60	12·21	362	·64
	12 M.		23·73	847	
	6 P.M.	·80	36·00	1318	
	10 P.M.	·85			
" 3rd	9 A.M.	·70	14·45	711	·16
	12 M.		29·85	2128	
	1 P.M.	1·20			
	4 P.M.	·40	22·54	2104	·00
" 4th	10 A.M.	·75	3·19	116	

It will be seen that the rainfall of the 1st March produced its effect on the 2nd, and that of the 2nd one much greater on the 3rd, when the maximum was reached.

Remembering that the breadth of the Onny is not more than some forty feet, the fact that at the rate of 2,128lbs. of mud per minute is sometimes carried down its bed in suspension is striking. But, besides this, a quantity of sand and pebbles must be rolled along the bottom, of which no account is taken here. The difficulty of arriving at any estimate of these in large streams is very great, but I would suggest that it might be possible to do so in smaller ones by simply sinking a suitable box in the bed when the water is low: into this the larger particles would fall and remain for further examination, while the sediment in suspension would pass away.

THE CRYPTOGAMIC FLORA OF WARWICKSHIRE.

BY JAMES E. BAGNALL.

In compiling this portion of the Warwickshire Flora I have endeavoured to bring together the various notes given from time to time on this subject, which are at present scattered through various works, so that those botanists who may feel inclined to follow up these investigations may be able easily to see what has been done already, and also to decide, with little trouble to themselves, whether the plants they find have been previously recorded, or are additions to our county flora. In compiling such lists as this the great difficulty is to settle the

synonymy of the plants, many of the names of the older botanists being now obsolete, and some transferred to other and frequently very different plants from those intended by past recorders. In the Lichens and Fungi I have found it extremely difficult in many cases to decide what plant such an author as Purton meant by the name under which he recorded it. To take a single instance, Purton records from Oversley Wood a rare Lichen under the name of *Lichen digitatus;* in "The English Flora," Vol. V., page 240, this is called *Scyphophorus digitatus*, and by Leighton, in "The Lichen Flora of Great Britain," page 68, it bears the name of *Cladonia digitata*. Thus in three standard works the same plant is placed in three different genera. Nor is this a singular instance. Hence if I should omit to notice some of the plants recorded by the older botanists it will be because I have been unable to trace them to their modern name.

In the Fungi I have received great assistance from the notes of that eminent fungologist, the late Mrs. Frederick Russell, of Kenilworth, and I have to thank her niece, Miss Worsley, for having so courteously allowed me to copy the list of Fungi found by her aunt in the neighbourhood of Kenilworth, Warwick, &c.—a most extensive list, the result of many years' careful and successful study of these plants.

The Moss Flora, with one or two exceptions, is compiled entirely from my own note book, and the sign ! after the name of a locality indicates that I have myself collected and examined the plant cited from that locality. Authentic specimens which I have seen from localities given on the authority of other collectors I have indicated by the sign ! after the *name of the recorder*.

The past records of Warwickshire mosses are very scanty, the only works within my reach in which any such records are given being Purton's "Midland Flora" and Perry's "Plantæ Varvicenses Selectæ," the notes in the latter being entirely copied from the first-named work. Unfortunately Purton has not given localities for any but the rarer mosses, and has, therefore, left it uncertain whether the mosses recorded as "common," "frequent," &c., were found by him in Warwickshire or in other parts of the Midlands. I have only recorded those mosses for which he gives a Warwickshire station, although I am convinced that many that I omit were found by him in this county.

The Moss Flora of Warwickshire is by no means an extensive one, and our really rare species are few in number compared with those of such counties as Surrey, Kent, or Gloucester. Still the county has yielded a few rare species, and has the merit, if merit it be, of having added at least two new species to the British Flora. The present list is, I am convinced, an imperfect one. Much of the county has been at present neglected, and to many districts I have been able to make only flying visits. From the neighbourhood of Rugby I have no notes. The Edge Hill district has only once been visited by myself; and I know of no records from that part of the county which lies south-west of the Edge Hills; in fact, so far as I have been able to make out, very little has yet been done in the southern portion of the county, and I am convinced that much good work still remains to be done.

This list will include the Musci, Hepaticæ, Lichens, and Fungi. The Algæ I shall leave for a more competent botanist.

The following is a list of the books used in this compilation, with the abbreviations employed in these papers:—

Purt.—" A Midland Flora," 2 vols., 1817. T. Purton.

Purt.—" An Appendix to the Midland Flora," in two parts, 1821. T. Purton.

E. F.—" The English Flora," Vol. V., Part II. Rev. M. J. Berkeley, M.A., F.L.S.

MUSCI.

The classification adopted is that of " The London Catalogue of British Mosses," by C. P. Hobkirk and H. Boswell, 1877, a classification which in my opinion has the merit of being a very natural one, and which will probably be adopted by the majority of working botanists.

In the following list I have only quoted the synonyms of the "Midland Flora," and the three works on British mosses most generally in use in this country, which are indicated as under.

Wils.—Wilson—" Bryologia Britannica," 1855.

Berk.—Berkeley—" Handbook of British Mosses," 1863.

Hobk.—Hobkirk—" Synopsis of British Mosses," 1873.

SECTION I.—ACROCARPI.

SPHAGNACEÆ.

1.—*Sphagnum acutifolium* Ehrh. Marshes and bogs, local. A very varying species, both in size and habit, often tinged with a reddish tint, fruiting in Autumn. Abundant in Sutton Park! Coleshill Bog! Trickley Coppice, in drains! New Park! July, August.

Var. patulum *Schimp.* On elevated grassy places, rare, growing in smaller, looser tufts, of a pale green colour, apparently rare in fruit. Fruiting in Autumn. Sutton Park! near most of the streams. Coleshill Bog! July, August.

2.—*S. fimbriatum* Wils. In marshes and bogs, rare. Sutton Park! in marshy ground above Blackroot Pool, destroyed by railway embankment in 1876, not found there since. Marshy ground in Bentley Park, near Atherstone, 1878! July.

4.—*S. squarrosum* Pers. Boggy places, rare. Sutton Park! near Bracebridge! Blackroot! Windley! and Powell's Pools! readily known by its very squarrose leaves. July, August.

Var. b. teres *Angst.* Marshes, rare. In marsh by Windley Pool, Sutton Park! 1876.*

7.—*S. intermedium* Hoffm. *S. recurvum*, Beauv., Hobk., Berk. *S. cuspidatum*, *b. recurvum* Wils. In bogs and marshes, very variable, local, rare in fruit. Abundant in Sutton Park! but usually barren. Coleshill Bog! fruiting. Trickley Coppice, in drains! July.

8.—*S. cuspidatum* Ehrh. Near streams, rare. In a drain in Trickley Coppice!

11.—*S. subsecundum* Nees. *S. contortum*, *b. subsecundum* Wils. Turfy bogs, marshes, local. Sutton Park! Coleshill Bog! Haywoods, in first drive below Woodman's cottage! Spring Wood, near Hockley! Cut-throat Coppice, near Solihull! July.

* I am somewhat in doubt as to the plant I find here being the true *S. teres* (Angst.)

Var. b. contortum *Schultz*. S. contortum *Wils.*, *Berk.*, *Hobk.* In marshes, bogs, and watery places, local, rare in fruit. Sutton Park frequent! Coleshill Pool! Coleshill Bog! Arley Wood! Bannersly Pool! Drive by Chalcote Wood! Cut-throat Coppice, near Solihull! In fruit in a small bog, near Great Packington.

Var. b. contortum, forma rufescens, *Nees and Hsch.* occurs in small pools in bog, near Packington Park! July.

Var. c. turgidum *Mull.* S. contortum, c. obesum *Wils.*, *Hobk.* In small pools, bog near Packington Park! In bogs above Blackroot Pool, Sutton Park!

Var. d. auriculatum *Lind.* In drains and wet bogs, rare. Above Blackroot Pool! Pool Hollies Wood! near Long Moor Mill Pool in drains! Sutton Park.

13.—*S. rubellum* Wils. Elevated places in bogs, rare. On the turfy tufts formed by *Molinia cærulea* in Coleshill Bog! fruiting in July. Dr. Braithwaite puts this as a variety of S. acutifolium in his Sphagnaceæ Britannicæ Exsiccatæ, No. 36, as I think correctly. July.

16.—*S. papillosum* Lind. Var. b. confertum. In bogs and near streams, rare. Sutton Park! fruiting in bog above Blackroot Pool! near stream above Bracebridge Pool! Pool Hollies Wood! July.

17.—*S. cymbifolium* Ehrh. In bogs and marshes. S. latifolium *E. B.*, 1405. Coughton Lane; Purt. Vol. II. The most frequent Warwickshire species; rare in fruit. Sutton Park! abundant, fruiting in Pool Hollies, 1875! Poor's Wood, Honily! Brown's Wood, near Solihull! Arley Wood! Trickley Coppice! New Park, Middleton! Coleshill Bog, fruiting 1876! bog near Packington Park! in quarry near Cornels End, fruiting! Fruits, Autumn.

Var. b. squarrosulum *Bry. Germ.* In bogs, rare; in several places in Sutton Park! Bentley Park, near Atherstone, 1878!

Var. c. compactum *Schultz.* On grassy hillocks near streams. This form I have only found in Sutton Park!

WEISSIACEÆ.

27.—*Systegium crispum* Hedw. *Phascum crispum* Wils., Hobk. On banks in fields, rare. In a field near Powell's Pool, Sutton Park, 1877! Fruiting, early Spring.

31.—*Gymnostomum tenue* Schrad. On sandstone rocks and walls, rare. On stone wall at Edgbaston! sandstone rocks, canal, near Rowington! sandstone embankment, Waterworks Reservoir, Aston! Fruiting Autumn.

35.—*G. microstomum* Hedw. On banks in a sandy or marly soil, local. Edgbaston (Cameron!) Olton, canal bank! Maxtoke, near the Priory! Sutton Park, on banks near Powell's Pool! 1877, Baker's Lane, near Knowle! 1879. Early Spring.

39.—*Weissia viridula* Brid. *Weissia controversa* Hedw., Wils., Hobk., Berk. Banks, common; near Knowle! Sutton Park! Acocks Green! Marston Green! &c.

Var. b. stenocarpa. Banks, local; near Knowle, Olton Canal bank. Spring.

40.—*W. mucronata* Bruch. On marly and clayey banks, rare. Olton Canal bank, March, 1868! on banks near Duke End! Spring.

42.—*W. cirrhata* Hedw. On trees, thatch, old palings, &c., frequent. Middleton Park! Olton! Solihull! Sutton Park, Maxtoke, near Priory! Arley, &c. Spring.

50.—*Dicranella crispa* Hedw. On sandstone rocks, very rare. On sandstone rocks, lane out of Sandy Lane, Milverton, April, 1877! It is probable that this species may be found abundantly in some of the districts on the Permian, as I find it plentiful on the Permian Rocks by the Hamstead Canal, Staffordshire. Fruiting, November.

54.—*D. cerviculata* Hedw. *Dicranum cerviculatum* Hedw., Wils., Hobk., Berk. On damp, turfy heaths and banks, near streams, somewhat local. Frequent in Sutton Park! Coleshill Heath!

55.—*D. varia* Hedw. *Dicranum varium* Wils., Hobk. On clay banks and heathy waysides, not common. Sutton Park! Plants Brook! Great Packington! canal bank near Knowle! Solihull! Shrewley Common! canal bank near Rowington! November.

56.—*D. rufescens* Turn. *Dicranum rufescens* Turn., Wils., Hobk. Very rare. On sandy banks, Tythall Lane, near Solihull! As I find this moss abundant on the Permian sandstone, near Hamstead, I think it probable that it may be also found in like places on the Permian rocks of Warwickshire. November.

59.—*D. heteromalla* Hedw. *Dicranum heteromallum* Hedw., Wils., Hobk., Purt. Common. Ragley Woods! Oversley Wood! Purt., Vol. II., p. 545. Sutton Park! Curdworth! Marston Green! &c. A form with very dark-green strongly cirrhate leaves occurs on damp banks, and is most frequently barren. Sandy and damp banks. November to April.

64.—*Dicranum montanum* Hedw. On the roots of oak trees, very rare. This plant was a new addition to the British moss flora when I first found it in 1870, and was abundant in Lower Nuthurst. The tree on which it grew has since been felled, and it is now only sparingly represented. Figured and described by Dr. Braithwaite, under the name of *Weissia truncicola* (De Not.,) to which species it was then referred, but afterwards decided to be *Dicranum montanum* by Dr. Lindberg. See "Journal of Botany," October, 1871, tab. 119, fig. 2. Recorded from Abbey Wood, Kent, "Journal of Botany," January, 1877, E. M. Holmes, Esq.

71.—*D. scoparium* L. Hedge banks, heaths, and woods, local. Rare in fruit. In fruit Brown's Wood, near Solihull! Tythall Lane, Solihull! School Rough, Marston Green! Oversley Wood! Poor's Wood, Honily! July, August.

72.—*D. majus* Turn. Woods, rare. Kirsley, near Coventry, in fruit, (T. Kirk!) Brown's Wood, near Solihull! Hart's Hill Hayes! July, August.

73.—*D. palustre* Brid. *D. Bonjeanii*, De Not. On banks, heaths, marshy places, old thatched roofs, &c., not rare. Sutton Park! always barren. Marston Green! abundant on an old thatched roof, Reddicap Hill, near Sutton! August.

75.—*D. spurium* Hedw. On damp heaths, very rare. On Coleshill Heath, (H. Webb!) This plant I have looked for frequently in the locality cited, but have never seen it. I have an authentic specimen collected by H. Webb from this locality.

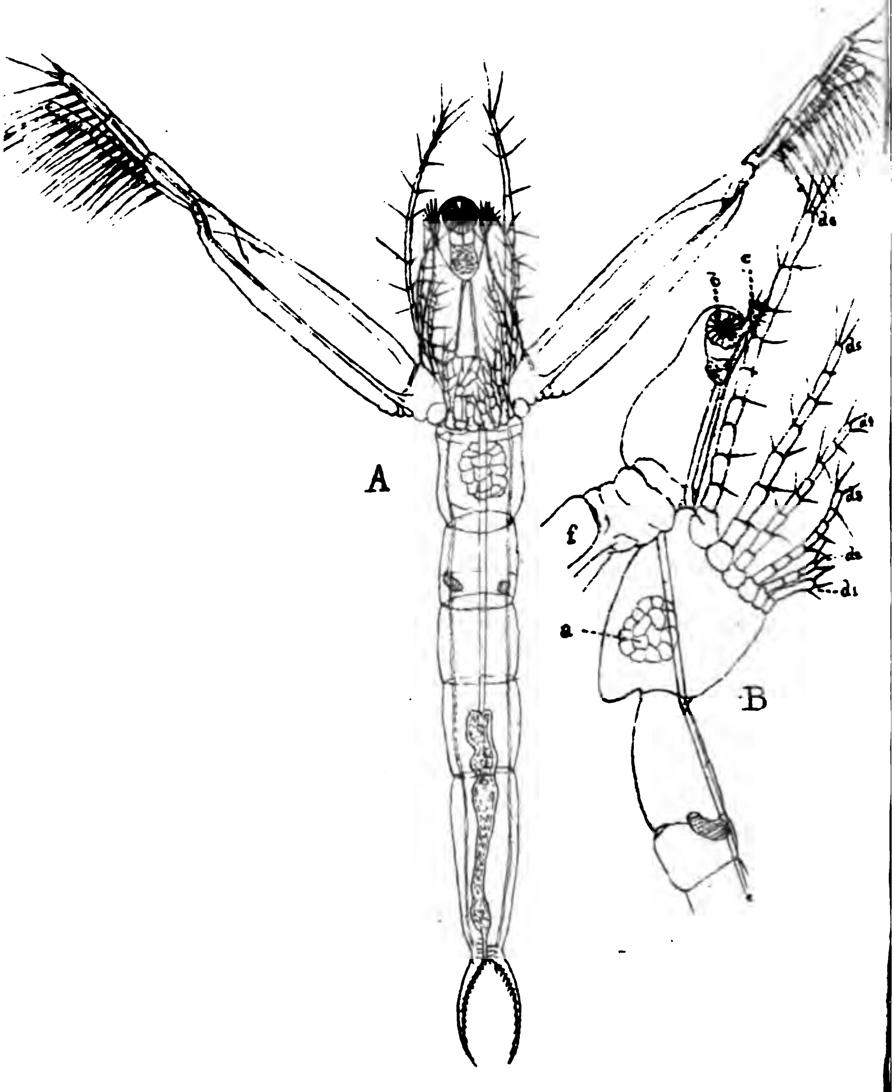
84.—*Campylopus flexuosus* Brid. *Dicranum flexuosum* Purt. "Rocks, high moors. The specimen which I found upon some very high ground in Ragley Woods was in close tufts." (Purt., Vol. II., p. 544.) I have never seen this moss in Warwickshire, but do not think Purton would make a mistake in the species.

88.—*C. fragilis* B. and S. *C. densus, b. fragilis* Wils. *C. densus* Berk. Heath lands, local. Sutton Park, frequent on heath lands, but very rarely fruiting. September.

90.—*C. pyriformis* Brid. *C. torfaceus* B. and S., Wilson, Hobk. On damp heath lands and the sides of streams and drains in a peaty soil, local. Abundant in fruit on boggy heath land above Blackroot Pool, Sutton Park, 1875. Coleshill bog, 1876. I believe that the variety b. Mülleri also occurs in Sutton Park, but I have never been able to get perfect specimens, so as to place the matter beyond a doubt. July, August.

[TO BE CONTINUED.]

Plate V.



H. E. Forrest, del.

Leptodora hyalina.

Fig. A × 50 diameters.

Fig. B, side view of Thorax and part of Abdomen × 60 diameters.

LEPTODORA HYALINA.

BY WALTER GRAHAM, F.R.M.S., PRESIDENT OF THE BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.

About three weeks ago a few members of the Birmingham Natural History and Microscopical Society visited a pool in the neighbourhood of Olton, which, being private property, is not often examined. Four of the party proceeded in a boat to endeavour to ascertain what treasures the water contained. The first dip caused no small excitement. A bottle of water, apparently containing diluted pea soup, was eagerly examined by one after another, for among the masses of a minute alga *(Clathrocystis æruginosa)* were swimming sundry apparently animated chips of thin glass. What was this translucent creature? was the question. The glass larva was speedily dismissed, but even the class to which the unknown capture belonged was doubtful, the best guess hazarded being that it was a larval form of some Entomostracan. Specimens were carefully secured for examination under higher magnifying power than pocket lenses afforded, and this examination revealed the fact that the mysterious stranger was no larval form, but a fully-developed Entomostracan, both eggs and young being detected beneath the carapaces of some specimens. But still its name was wanting. "Baird," and the "Micrographical," and "Pritchard" failed us, but Professor Ray Lankester came to our aid, for, on having specimens submitted to him, he pronounced it to be *Leptodora hyalina*, a species new to Great Britain, though found in Sweden and Germany. Curiously enough the same "dips" which gave us Leptodora gave us also another new British species, which is described at page 217.

In the hope that other students of this class may meet with Leptodora, the following imperfect description is given, which, with the help of the accompanying plate, (Plate V.,) drawn by my friend, Mr. H. E. Forrest, may enable them to identify the crystalline stranger. Leptodora belongs to Baird's Legion Branchiopoda, Order II., Cladocera, Family I., Daphniadæ. The head is elongated, not beaked. Superior antennæ long, and studded with setæ. The inferior (or propulsive) antennæ are large and very powerful, producing a motion similar to that of a man swimming. The first joint occupies fully half the length of the antenna. From it two equal branches proceed, which are four-jointed, and are studded with setæ, while the first joint is smooth. On each side of the head, immediately under the eye, is a small organ covered with cilia. The feet are ten in number, close together, and setaceous.

The carapace is extremely hyaline, divided into seven segments; the tail is produced into two curved extensions resembling that of an earwig, excepting that in Leptodora these extensions are furnished with long, slender setæ. The body is long and narrow, and so translucent that the

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REFERENCES TO PLATE V.

Fig. A.—Leptodora hyalina, × 50 diameters.

Fig. B.—Ditto, × 60 diameters. *a*, Pulsating vessel. *b*, Eye. *c*, Organ of hearing (?) *d* 1 to 5, Feet. *d* 6, Superior antennæ. *e*, Tube or intestine. *f*, Inferior antennæ.

internal organs can be clearly seen. A large contractile organ is situated immediately behind the eye, connected by two nerves (muscles?) with the muscular centre between the inferior antennæ. A pulsating vessel occupies the first segment behind the antennæ. A long straight tube or intestine passes from the first or head segment to the last segment but one, where it enters a wide cœcal vessel, somewhat convoluted or corrugated, which terminates at the bifurcation of the tail. Both male and female specimens were secured, the female differing in having a larger carapace, extending over the first and second segments of the body behind the inferior antennæ, under which carapace the ova and young are retained until the latter are sufficiently developed to leave the parent. The young resemble the parent, but are thicker in proportion to their length, and the antennæ are shorter than in the adult.

The specimens taken (adult) varied from ¼in. to nearly ⅜in. in length by about 3-64in. across the body, immediately in front of the inferior antennæ.

Sir John Lubbock has called attention to the capture of this species in some remarks made before the Biological Section of the British Association at Sheffield.

EXAMINATION OF DRIFT.

RAILWAY CUTTING NEAR WALSALL.

BY C. BEALE, C.E.

Referring to the paper with this heading (*ante*, page 201) I wish to make a few remarks, notes of a late visit to the work.

The excavation, though not to the full depth, has now reached the Walsall and Wednesbury road, which has been temporarily diverted. The character of the deposit at this point seems to have undergone a considerable alteration from that obtaining near the junction with the main line. At this latter place the deposit was exceedingly uncompacted, the sand appearing to have little or no cohesion, and being of a rather pale colour. Under the road, on the contrary, the colour is many shades deeper, the cohesiveness, also, is increased to almost the compactness of a conglomerate, and the pebbles composing the gravel are of a more uniform size than those at the beginning of the work.

Crossing the road to the cutting at the James Bridge end of the line, I find that in the progress of the work here a difference is exhibited in the character of the deposit.

The appearances here indicate, I think, that there must have been a considerable shoal or sand bank near the site of the old pools at the back of Bescot Hall. The white sand shown at this point may or may not be the top of this shoal, but judging by present appearances it looks probable that the top of the shoal was situated almost exactly on the site of the pools. That there was a shoal here may be inferred, I think, from the purity of the sand, its comparative freedom from pebbles and stones, (if not their entire absence,) and the rise of the deposits towards this point from either end of the new line. The thin band of drift coal and smut

is now not far off the top of the cutting, and may be expected to be found on the surface in the course of the next fifty or sixty yards. This band of coal and smut, if found only on the north side of the shoal, would indicate that the current of the then existent sea set in a southerly direction, and that the coal was abraded from the outcrop of the fire-clay and bottom coals between here and Bentley.

One thing that struck me in Mr. Twigg's paper was the absence of all note or remark as to the wavy appearance of the various bands of the deposit at this north end, indicating, as I take it, the shallowness of the water, or the depth and strength of the wave force. The appearance is very curious, and is well worthy of examination. The waviness referred to is shown in Fig. 67 of Richardson's "Geology and Palæontology," 1851 edition, though not from the same cause as in the woodcut.

I should also like to direct attention to another cutting on the Old Grand Junction Line of Railway, about half-way between Newton Road and Great Barr Stations, where we find another instance of, I think, a shoal, but of very much grander dimensions than that just referred to near James Bridge. It begins near the present bed of the Tame, a little lower down than the Old Forge Pools, and runs inland for about a mile and a half, under "the Hem" on the Ordnance one-inch maps, towards the Birmingham and Walsall Road. The section exhibited in the railway cutting shows the base rather more than half a mile wide, and the height of the bank or shoal is about 80ft. above the present level of the stream, or about 60ft. to 65ft. above the level of railway. At the bottom of this cutting we have sand, and as we go up we get sand mixed with pebbles, at first few in number, but increasing in quantity till we come to the top, where we get the ordinary drift gravel of the district capped with clay.

At a height of about 25ft. to 30ft. above the rail level there may be found, sometimes in considerable quantities, pebbles or water-worn pieces of coal, varying in size from that of a marble to that of a cocoanut. These are principally found on the east side of the cutting, and from the configuration of the ground here it would appear as though this bank or shoal began to be formed against the high ground upon which the Walsall Road is situated, and was gradually extended to the point at which we now find it below the Old Forge.

The whole of the various deposits, with their associated foreign contents, suggest the belief that the general contour of the country, as it exists at present, remains unchanged from the date of the last great immersion, and that no great dislocation or contortion has taken place during the many ages that must have elapsed since that immersion.

I have, in these remarks, inadvertently used the words "the ordinary drift gravel of the district," but I do not think the gravels here *are* the ordinary drift gravels of the district. I think the gravels and pebbles about here are the gravels and pebbles of the bottom and shores of the sea—as it then existed—exactly similar to the gravels and pebbles lining the bottom and shores of now existing seas, and are in no sense to be confounded with the drift gravels covering such a large area of these Midland Counties, the component parts of the latter being principally derived from far distant localities, while those of the former are, on Mr. Twigg's evidence, derived from sources comparatively near.

EXCURSION OF THE BIRMINGHAM NATURAL HISTORY SOCIETY TO FALMOUTH,

JULY 5TH TO 13TH, 1879.

BY JAMES E. BAGNALL.

Although we had cold and wet weather during our excursion to this neighbourhood, a fair amount of botanical work was done, but in this note I can merely glance at some of the general features, reserving my full report for the present. In the immediate neighbourhood of Falmouth about 350 species of flowering plants and ferns were noticed, and adding to these the plants seen in our longer excursions to Land's End and Lizard Point, over 400 different species were observed during our visit. Many of these were very rare, and some of them special to the locality in which they were observed. But for the backwardness of the season and the inclemency of the weather, our list would probably have been very much longer.

The coasts and cliffs in the immediate neighbourhood of Falmouth, so far as I was able to notice, appear to be barren rather than prolific in truly seaside plants, such as the Saltwort *(Salsola Kali,)* Seablite, *(Suæda maritima,)* the Glasswort, *(Salicornia herbacea,)* Sea Lavender, *(Statice,)* *Glaux maritima*, Sea Holly, *(Eryngium maritimum,)* and other such plants. Still, I was very much pleased with the flora of the cliffs, covered as they were with masses of the Ladies' Fingers, *(Anthyllis,)* which were still beautiful, though past their prime. Dense patches of Stonecrop *(Sedum Anglicum)* greeted one's eye frequently, growing constantly in company with the rare variety of the Sand Spurrey, *(Spergularia rupestris,)* which is one of the common plants here. Dark-green tufts of Sea Plantain, *(Plantago maritima,)* glaucous tufts of beautiful Thrift, *(Armeria maritima,)* tangled masses of Sea Beet, *(Beta maritima,)* forests of the golden-flowered Black Mustard, *(Brassica nigra,)* here and there straggling patches of Scurvy Grass, *(Cochlearia officinalis* and *danica,)* Wild Carrot, *(Daucus carota,)* and abundance of the comparatively rare Alexanders, *(Smyrnium olusatrum,)* which is said to have been introduced here, but if so it is now well established and abundant; splendid specimens of the Navelwort, *(Cotyledon Umbilicus,)* bearing spikes of flowers more than a foot long, with large patches of the Pellitory *(Parietaria officinalis,)* and here and there the more rare Samphire, *(Crithmum maritimum.)* These are the principal and most striking plants on the cliffs round Falmouth Bay.

About a mile from Falmouth is a fine freshwater pool, called Swan Pool, in which I found the Sea Sedge, *(Scirpus maritimus,)* and *Scirpus Tabernæmontani*, and *Ranunculus Baudotii*, all fairly abundant.

The lanes about here are many of them very charming, beautifully bowered over with trees, and all so charmingly green, greener even than Warwickshire lanes, and rejoicing in such wonderfully verdant banks, often many feet high and clothed from top to bottom with a very profusion of growth. Wherever a particle of soil could lodge, something beautiful seemed to vegetate luxuriantly. The Hart's Tongue*(Scolopendrium*

vulgare) was remarkably abundant, and in many cases the fronds were more than two feet long; beautiful tufts of the Black Spleenwort, *(Asplenium Adiantum-nigrum)* occurred on every bank, and plants were to be found varying from tiny fronds scarcely an inch in length to fine fronds considerably more than a foot long. Fine forms of *Polystichum angulare* were very frequent on the marly banks, whilst more rare, although fairly abundant, in some of the lanes was the hayscented Shield Fern *(Lastrea æmula.)* On some of the banks near Swan Pool, I found a fine crop of *Agrostis setacea*, a plant I had never before seen growing; and on the rocks near Maen Porth and other places the English Clary *(Salvia Verbenaca)* and Fennel *(Fœniculum vulgare)* were abundant.

It was very pleasing, too, to see some fine specimens of the Sea Spleenwort *(Asplenium maritimum,)* in caves near the Swan Pool, but in every case too far out of reach to be obtainable. Some splendid plants, however, were obtained by my friend Mr. Morley, near Mawnan, and with his usual generosity distributed to less fortunate fern seekers. I was also struck with the fine tufts of the Royal Fern *(Osmunda regalis,)* which were occasionally seen, but only rarely what I should consider as native, and some of the specimens of the Lady Fern, *(Athyrium filix-fœmina,)* were very beautiful and far more graceful, and in some cases much taller even than Osmunda.

ENTOMOLOGICAL RAMBLES IN THE MIDLANDS.

No. I.—BEWDLEY FOREST.

BY W. G. BLATCH.

(Continued from page 196.)

Having indulged in a fair amount of rest and refreshment, we long to resume our charming and instructive ramble, and are soon out again amongst the insects, at the first step meeting with "good things." One of the lads here brings us a fine male specimen of the Stag-beetle, *Lucanus cervus*. Just outside the door, close by the Mill, two species of *Dyschirius* turn up, viz., *D. politus* and *D. globosus;* and, in the same place, troops of *Steni*, like soldiers clad in close-fitting armour, some of them having their lead-coloured wing-cases relieved with orange spots, are marching busily to and fro; amongst them we recognise (and capture) the aristocratic-looking *Dianous cærulescens*, *Stenus biguttatus*, *S. bipunctatus*, *S. guttula*, *S. bimaculatus*, *S. Juno*, and others. The neat and extremely active little *Bembidium articulatum* abounds, as also do *Elaphrus riparius* and *E. cupreus*. Flying around a sallow by the mill-stream are numerous specimens of *Hoplia philanthus*, and from the same kind of trees a little further on are beaten two species of *Clythra—tridentata* and *quadripunctata*, the first-named being quite a red-letter capture. From nut and alder we beat *Phyllobius calcaratus*, and *C. pyri;* from birch, *Apoderus coryli*, *Zeugophora subspinosa*, and the marvellously beautiful larva of the scarce Vapourer moth, *Orgyia gonostigma;* and from young oak, *Attelabus curculionoides*.

On the large flowers of the "Moon-daisy" we find *Strangalia melanura* and *Grammoptera tabacicolor*—two desirable Longhorns; and on the milk-weed, (spurge,) especially by the brook-side, *Strangalia nigra*. Some species of *Donacia* are sunning themselves on the flags and Potamogetons, but we content ourselves with securing *D. bidens* and *D. typhæ;* the latter bears a purplish-coppery streak on each elytron, and is rather scarce in our parts. Amongst the stones by the brook swarms of *Bembidia* disport themselves, and examples of the following species are captured:—*B. obtusum*, *æneum*, *Mannerheimi*, *decorum*, *monticola*, *brunnipes*, *tibiale*, *atrocœruleum*, *bruxellense*, *flammulatum*, *varium*, *punctulatum*, &c., and in company with them a beetle new to us: it is red and black, runs with its tail curled over its back, and looks vastly like a *Myrmedonia*. To catch it and put it in a small glass tube is a momentary operation; the pocket-lens is then brought to bear on it, and we discover that our new friend is *Deleaster dichrous*, another name to be recorded in red ink. A bit further up the brook, on a spot from which every breath of wind is excluded by the encompassing woods, and where the sun's rays seem to actually broil us, are more good things, calling for the further use of "ink of sanguine hue!" What have we found now? Why, that graceful, girl-like beetle, with the slender waist, *Tachyusa constricta*, which we have not seen since taking it by the Mole at Leatherhead, and in company with it is the most curious and droll of all small beetles. Stoop down and look at it. You cannot see it? Lie down on the sandy bank of the stream and look closely. Do you now see a number of small grains of mud moving slowly about as if endowed with life? See, they march to and fro, hither and thither, evidently controlled by some hidden intelligence, and mark how certain of them seem to possess a powerful attraction for each other. As long as you lie quiet and look on, their activity appears rather to increase, but put forth your hand and touch the ground on which they move, and instantly all is still. Take one up as soon as it begins again to stir, and examine it: you will find upon rubbing it gently between your fingers, and thus removing the mud-case enclosing it, a small, roundish, rather long-legged, coarsely-punctured, black beetle, about three-quarters of a line in length, the *Georyssus pygmæus* of naturalists. It always covers itself with a coating of mud in this droll way—no doubt finding some advantage in it—not improbably protection from its active little neighbour *Tachyusa constricta*, and the hosts of *Lycosæ* and other spiders that watch and hunt for prey in the damp places in which it loves to dwell. This amusing though diminutive beetle is the only representative of its family and genus in this country, and is generally considered to be a coast insect; besides on this spot, I have taken it only at Luccomb Chine, in the Isle of Wight.

Having bottled as many *constricta* and *pygmæus* as required, and the stooping posture having made our heads and backs ache, let us for a few minutes assume the recumbent attitude on yonder heather-clad and shady slope, previous to breaking fresh ground. What is the matter? Ants? "Yes; and how they bite!" But never mind; even ants have their entomological uses. Where's their nest? Under this stone, perhaps; so over it goes! And what do we see? Not only ants, but

positively some of those curious beetles of which we have often heard as inhabiting ants' nests are here—*Dinarda Märkeli*, *Atemeles emarginatus*, *Myrmedonia humeralis*, and *M. canaliculata*. Well, we have our revenge upon the ants for their keen bitings; but suppose we make other reprisals before abandoning them? Let us attack that large nest on the right, first tying our sleeves tightly at the wrists, and tucking our trousers in our socks, to prevent the ants making unpleasant reprisals upon us. Spreading a large sheet of paper on a convenient heather bush some distance from the nest, we advance upon the enemy, and boldly and quickly plunge our hands into the midst of their citadel, part of which we take away and carefully shake over the paper. This operation is repeated two or three times, care being of course taken not to destroy the nest, and upon reckoning up our captures we find ourselves in possession of more *Dinarda* and *Myrmedonia*, *Megacronus inclinans*, *Thiasophila angulata*, *Oxypoda formicetorum*, *Myrmetes piceus*, *Monotoma angusticollis*, and hosts of *Homalotæ*. From the mouth of one of the ants we took a fine specimen of *Myrmedonia humeralis*, much larger than itself, which it appeared to be carrying, with affectionate care, to a place of safety. Gladly would we renew the combat, but, remembering that "discretion is the better part of valour," we desist. (To tell the plain truth, the ants are too many and too active for us, and we feel compelled to retreat!) Upon reaching neutral territory we rest ourselves, pick off the stray ants which persist in following and worrying us, and examine by means of our glasses the queer-looking beetles captured from their friends, (or enslavers, as the case may be,) and which, but for our interference, would probably have passed the rest of their lives in the midst of a colony of *Formica rufa*, in comparative darkness, and surrounded with an atmosphere of formic acid. Looking through your glass you observe that such of the beetles as are peculiar to ants' nests, as *Dinarda*, *Atemeles*, &c., have their armour-plates, so to speak, sculptured in a special style, the whole upper surface of the body, especially the thorax and elytra, being beautifully chased in such perfection of execution as to shame even the most skilful worker in fine gold, who, were he willing, might learn valuable art lessons from these obscure and despised insects.

The questions you naturally ask as to the reason why of these beetles being domiciled with the ants are not easily answered. What the connection between them is—whether the ants attract the beetles, or the beetles fascinate the ants—whether the motives of either or both are those of friendliness or self-interest—is at present involved in mystery. It has been observed, as we ourselves have seen, that the ants certainly manifest some degree of attachment to their guests, and we know that, though very destructive to insects generally, they cherish these particular species with praiseworthy devotion and care. The subject is one of much interest, and the temptation to pursue it almost irresistible, but we must choose some other opportunity to speculate upon it. Both time and insects fly, and if we stop to talk now we shall soon find the hour of departure close upon us, and our entomological sport curtailed. Let us, then, now cross the brook and ascend the wooded hill, beating the birches and other trees as we go. Here are various species of *Rhynchites* in

abundance—*R. pubescens* being one of them—and on the leaves of young oaks the curious and active *Agrilus viridis*, which must be bottled quickly, or it will be gone. By beating a crab tree we secure a specimen of the remarkable pupa of *Ledra aurita*, a fine name by which entomologists recognise a rather rare member of the "bug" tribe; from a small grove of young aspens we obtain *Saperda populnea*, *Gonioctena rufipes*, and *G. viminalis;* the sallows close by yield a new Longhorn beetle, which it is a great pleasure to see, viz., *Liopus nebulosus*, as well as some larvæ of *Notodonta ziczac*. In beating the margin of the wood a number of moths are disturbed, and, amongst others, are recognised and secured *Angerona prunaria*, *Melanthia albicillata*, *Melanippe hastata*, and the very pretty *Ennychia octomaculalis*. After disposing of these, we examine the proceeds of our beating exertions, and find lots of nice things, including the stick-like larvæ of *Phigalia pilosaria* and *Amphydasis prodromaria;* two odd-looking spiders, *Epëira bicornis* and *E. conica*, and a perfect swarm of wood-ants, which manifest an almost boy-like predilection for climbing up every available tree. On the flowers of a rhododendron, by the side of a small stream, are observed a number of gaily-decorated little moths, busily engaged sipping nectar, and as they prove to be *Anarta myrtilli*—a species that is "wanted"—we carefully box a few specimens. Turning over two or three stones lying near us brings to light a single example of the elegant beetle *Cychrus rostratus*, together with specimens of the glow-worm, *Lampyris noctiluca*, the female still bearing the semblance of its larva-hood, and the male looking like a beetle "Friend" in his straight-cut suit of sober brown-black. This species may be taken abundantly in the forest at night—the females amongst the herbage, and the males flying—both of them exhibiting their wonderful light, that of the female, however, being by far the most intense. I have found larvæ of this insect feeding on living snails, *Helix aspersa* and *H. nemoralis*.

Our steps are now resolutely set in the direction of the keeper's cottage, where we propose to take tea previous to quitting this fascinating region. But our resolution is soon put to the test and found wanting; for, although our success has been beyond our hopes, we are not able to pass by a likely-looking beetle-trap without subjecting it to examination. Hence that group of suspended moles, dead and dry, is tapped over the inverted umbrella, and lo! quite a shower of the beautifully-tinted *Dermestes murinus* drop out. Those rotting fragments of an old saddle must also be looked over with care. What! Insects there? Yes! here is *Trox sabulosus*, sixteen fine specimens, in appearance like bits of caked mud. That these apparently inanimate objects are endowed with vitality certainly seems open to question, until, holding one upside-down between your fingers, and applying gentle pressure laterally, you see the abdomen slightly move, and hear a sound almost like the wailing of a sickly infant.

But we really must not linger over this wailing mimic; our time has nearly run out, and tea and train must now occupy the leading place in our thoughts, to the exclusion of beetles and butterflies. It is hard, however, to drag ourselves away from the many attractions by which we are surrounded here, and only when a sort of compromise is mentally entered into, to the effect that we will take the first opportunity of returning, do we, reluctantly yielding to the force of circumstances, consent to rejoin the current of social life, which, during one day, we seem to have quitted for Fairy Land.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF JULY, 1879.

BY W. JEROME HARRISON, F.G.S.

STATION.	OBSERVER.	RAINFALL. Total for M. In.	RAINFALL. Greatest fall in 24 hours. In.	RAINFALL. Greatest fall in 24 hours. Date.	RAINFALL. No. of rainy d.	TEMPERATURE. Greatest ht. Deg	TEMPERATURE. Greatest ht. Date.	TEMPERATURE. Great'st cold Deg	TEMPERATURE. Great'st cold Date.
GLOUCESTERSHIRE.									
Cheltenham	R. Tyrer, Esq.	3·61	1·10	13	22	77·0	29	44·0	11
Stroud	S. J. Coley, Esq.	3·45	·81	1	18	73·0	19	45·0	11
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	3·69	·76	13	20	75·0	29	44·0	26
Woolstaston	Rev. E. D. Carr	3·12	·65	13	23	51·0	28	45·0	5
More Rectory, Bishop's Castle	Rev. A. Male	2·84	·48	13	22	77·0	28	44·0	6
Bishop's Castle	E. Griffiths, Esq.	3·58	1·25	13	21	76·0	29	46·0	6
Cardington	Rev. Wm. Elliott	2·89	·42	19	17				
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	2·13	·36	14	21			40·0	11
Stoke Bliss	Rev. G. E. Alexander	2·61	·46	13	19	74·0	29	47·0	5, 10, 26
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq	3·44	·86	13	22	77·2	29	42·0	6
West Malvern	A. H. Hartland, Esq.	3·29	·45	12	21	81·5	29	44·0	10
Pedmore	E. B. Marten, Esq.	3·67	·66	14	20	81·0	18	46·0	5
Longlands, Stourbridge	J. Jeffries Esq.	3·39	·45	14	17	82·0	29 & 30	42·0	5
Dennis, Stourbridge	Mr. C. Webb	3·37	·50	14	20	76·[illegible]	28 & 29	43·5	5
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	4·69	1·50	14	19				
Dudley	Mr. J. Fisher	3·71	·53	20	20	82·0	29 & 30	44·0	5 & 26
Sedgley	Mr. C. Beale	3·20	·62	14	19	72·0	29	45·0	5
Kinver	Rev. W. H. Bolton	4·47	·92	14	17	80·0	29	44·0	26
Walsall	Mr. N. E. Best	3·50	·63	14	22	75·0	28	47·0	10
Grammar School, Burton	C. U. Tripp, Esq.	2·50	·54	19	19	80·0	28	45·0	11
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	4·75	1·06	13	22	82·0	29	46·0	6 & 11
Wrottesley	E. Simpson, Esq.	5·28	1·80	14	18	76·2	29	45·9	27
Heath House, Cheadle	J. C. Philips, Esq	3·67	·70	19	19	72·0	28 & 29	43·0	2
Alstonfield Vicarage	Rev. W. H. Purchas	4·42	·77	8	16	76·0	28 & 29	35·9	1
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	3·21	·47	8	16	78·0	28	49·0	5
Coventry	J. Gulson, Esq.	3·19	·46	13	16	77·0	30	45·0	6 & 11
Bickenhill Vicarage	J. Ward, Esq.	3·87	·56	13	22	73·0		49·0	
St. Mary's College	Rev. S. J Whitty	3·19	·43	20	20	75·3	29	44·8	11
Henley-in-Arden	T. H. G. Newton, Esq.	3·31	·58	14	17	79·0	29	44·0	6
Rugby School	Rev. T. N. Hutchinson	3·56	·51	19	19	75·8	29	44·0	6
DERBYSHIRE.									
Stoney Middleton	Rev. U. Smith	3·74	·90	20	17	7[illegible]·0	29	35·0	10 & 11
Fernslope, Belper	J. G. Jackson, Esq.	3·41	·50	19	19	77·0	28 & 30	45·0	11
Brampton S. Thomas	Rev. J. M. Mello	3·02	·64	19	14	75·5	28	43·0	13
Linacre Reservoir	C. E. Jones, Esq	3·0[illegible]	·83	19	18				
Spondon	J. T. Barber, Esq.	2·99	·52	19	20	71·3	28 & 29	42·8	
Duffield	W. Bland, Esq.	2·89	·46	19	19				
NOTTINGHAMSHIRE.									
Hesley Hall	B. J. Whitaker, Esq.	3·66	·71	21	17	79·0	30	43·0	13
Tuxford	J. N. Dufty, Esq.	3·82				89·0	28	45·0	11
Hodsock Priory, Worksop	H. Mellish, Esq.	2·98	·62	21	17	77·8	28	43·1	26
Highfield House, Nottingham	E. J. Lowe, Esq.	3·67	·57	14	19	74·2	18	45·7	11
Park Hill, Nottingham	H. F. Johnson, Esq.	3·46	·45	19	17	75·7	29	48·4	10
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	2·66	·35	8 & 31	20	78·1	29	46·2	11
Ashby Magna	Rev. E. Willes	3·27	·55	13	19	79·0	29	42·0	11
Market Harborough	S. W. Cox, Esq.	4·13	·75	20	23	75·0	30	43·0	6 & 25
Kibworth	T Macaulay, Esq.	3·82	·59	20	22				
Town Museum, Leicester	W. J. Harrison, Esq.	3·72	·75	13	23	75·6	28	46·5	11
Belmont Villas, Leicester	H. Billson, Esq.	3·69	·78	13	18				
Syston	J. Hames, jun., Esq.	2·74	·39	31	23	78·0	29 & 30	45·0	11
Waltham-le-Wold	E. Ball, Esq.	3·93	·58	13	0	78·0	28	43·0	1
Little Dalby Hall	G. Jones, Esq.	3·96	·60	21	21	85·0	29	41·0	11
Foxton Locks	Union Canal Company	2·99	·44	20	19				
Coston Rectory, Melton	Rev. A. M. Rendell	4·25	·77	21	22	74·2	28 & 29	38·7	26
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	3·85	·61	20	16				
Castle Ashby	R. G. Scriven, Esq.	3·08	·40	20	19	78·0	29	47·0	5 & 10
Kettering	J. Wallis, Esq.	3·99	·65	20	20	75·0	30	47·0	11
Althorpe	G. S. Groom, Esq.	3·40	·61	20	19	75·0	29	45·0	10
Pitsford	C. A. Markham, Esq.	3·28	·50	20	20	81·0	29 & 30	42·0	25
RUTLAND.									
West Deyne, Uppingham	Rev. G. H. Mullins	3·38	·46	21	19	74·8	28	44·8	11
Northfields, Stamford	W. Hayes, Esq.	2·77	·74	7	17	84·0	29	39·0	12
Ventnor Hospital	W. T. Ryder, Esq.	3·73	1·10	19	12	68·9	29	49·9	11
Altarnun Vicarage	Rev. J. Power	7·77	1·47	1	24	85·0	30	47·0	5, 16, 25

KK

July proved a rainy, ungenial month, with an average temperature of from four to five degrees below the average. Cloudy skies, with south-westerly winds, often strong, prevailed till the last week of the month, when there were a few bright summer-like days. The barometer was unsteady and not high. Severe and general thunderstorms occurred on the 13th and 14th. Hay-cutting not general till the 27th, and all farming operations much hindered and damaged by the weather. From the 11th to the 17th, the wind blew from the east, and fogs are reported from several stations. Solar and lunar halos were seen at Nottingham on the 30th.

NATURAL HISTORY NOTES BY OBSERVERS.—*More Rectory.*—The curlews have been restless during the month, crossing our valley to the neighbouring hills. *Ashby Magna.*—Fruit and flowers, as well as vegetables, very backward. Hay harvest did not begin in this parish till July 15th; much has been well got in the last three days of the month. *Waltham-le-Wold.*—Wheat not in ear till the 20th. Hundreds of acres of oats and barley will not come into ear at all. Bees, both old stocks and new swarms, are starving. *Loughborough.*—Harvest operations fully six weeks late. *Burton-on-Trent.*—1st, wild Yellow Iris, fl.; 4th, Elder, fl., first hay cut; 9th, White Rose, fl.; 7th, Woodbine, fl.; 18th, Barley in ear; hay-making general, but damaged by floods. *Shifnal.*—Apples, of which there was a great prospect, almost all fell off; no butterflies. Peas first gathered 11th, Strawberries 13th. *Stroud.*—List of flowers noticed and time of blossoming:—1st, Butterfly Orchis; 2nd, *Prunella vulgaris*, Dulcamara, *Sedum acre*, *Aconitum Napellus*, Meadow-sweet; 4th, Eyebright, Common Ragwort; 8th, Viper's Bugloss, *Scabiosa columbaria*, *Galium uliginosum*, *Digitalis purpurea*, *Ranunculus Lingua*; 12th, *Epilobium montanum*, *Alisma Plantago*, *Stachys sylvatica*, *Achillea millefolium*, *Medicago lupulina*; 15th, *Juncus uliginosus*, *Centaurea nigra*, *Malva sylvestris*, *Valeriana rubra*; 17th, Great Mullein, *Geranium pratense*, *Lonicera Periclymenum*; 18th, *Chlora perfoliata*; 20th, *Campanula rotundifolia*; 24th, Bee Orchis; 26th, *Malva moschata*, *Reseda Luteola*, *Linaria vulgaris*; 31st, Red Bartsia, Corn Cockle, Wild Basil, Red Pimpernel, Common St. John's Wort. *Nottingham, Highfield House Observatory.*—3rd, Rhodendrons, Ghent Azaleas, Double Scarlet Thorn, Laburnum, Brown Iris, and *Hemerocallis flavus* still in bloom; 6th, Snowball Tree, *Heracleum giganteum*, and Yellow Briar in fl.; 12th, Elder in fl., Strawberries ripe; 20th, *Deutzia scabra* in fl.; 21st, Portugal Laurel in fl.; 27th, *Spiræa ærifolia* in fl., also *Deutzia scabra plena*; 29th, *Spiræa palmata* in fl.; 31st, Roses in full glory, some Rhododendrons yet in fl. *Moseley, near Birmingham.*—August 20th, a large pyramidal Pear Tree is this day in full bloom, as though it were Spring; Roses were more than a month late in blooming; they have continued in great beauty up to now.

Correspondence.

A LONG SLEEP.—On July 6th, 1875, I found five larvæ of the Puss Moth *(Cerura vinula)* feeding upon willow. These I placed in a breeding box, with their food stuck into damp sand, and after a time they spun their cocoons in the corners and on the sides of the box, and four of them emerged all right in the following May, (1876.) The remaining one I fancied dead, but did not examine the cocoon, and not wanting the box

again it was put away in an empty room, and there it remained until August 1st, 1879, when the box was wanted for a purpose which necessitated cleaning it out. In doing this I pulled the five cocoons down, and was much surprised to find the pupa in the one which I had looked upon as dead still alive and really "kicking." On closely examining this cocoon I noticed that the larva had spun it in a horizontal position just below the sand, and in a corner of the box, one end joining the left-hand side, leaving the other end free, from which the moth ought to have emerged had not the larva made a strange mistake by changing to the pupa with its head towards the end joining the wood on the left-hand side of the box, and which it could not possibly penetrate. How long it might have remained alive of course no one can tell; however, on being placed on the mantel-shelf, in a cool room, the moth emerged, after having been in the pupa state for more than four years!—Fred. Enock, 30, Russell Road, London, N.

The Bee-eater (*Merops apiaster*) to which reference is made at pp. 188 and 210, was shot at Mapperley, near Derby, on June 10th, 1879. It was a male bird, in very fine plumage, and was set up by me for the person who shot it, but I afterwards purchased it for the Nottingham Free Museum, to which I am taxidermist. There was another bird shot before the one I had, which I did not see; probably a female. The bird I had was a wild one, and had not been kept in a cage. I shall be very pleased to give any further particulars of it to anyone who may call on me.—L. Lee, Naturalist and Taxidermist, 26, Drury Hill, Nottingham.

Ornithology.—A very fine specimen of the "Honey Buzzard" was shot by Mr. Beech's keeper in the Brandon Woods. It is now at David Smith's. Its crop was found stuffed with caterpillars, grubs, dragon flies, and other insects, upon which this species usually feeds. It rarely takes small birds, or anything larger than caterpillars and insects. It often takes bees, but appears to have no fondness for honey, as its name would imply. A pair of "Hobbies" were also shot at Combe by Lord Craven's keeper a few weeks since. The nest and eggs were also taken from a high tree, in which they had built.—J. Gulson, Coventry.

The Scriptograph.—Directions for making and using:—*Material for making the pad:* 1oz. gelatine, 6oz. glycerine (common,) 1oz. lum sugar, 4oz. water, 2½oz. barium sulphate. Heat the gelatine, water, an sugar in a water bath, well stir the barium sulphate with the glycerin and incorporate all together. Pour into a tin mould, 11in. by 7½in. by ½in deep. To make the ink, rub up the solid aniline violet with gum water and thin with methylated spirit until it flows freely from the pen. *To u the apparatus:* Write on any paper; when dry, place face downwards o the pad; allow to remain about a minute; then peel the paper off. Th lay on the slab unglazed paper, and smooth with the fingers. Fifty 100 copies may be taken. When sufficient copies are taken, remove th writing with a wet sponge. When the pad becomes deteriorated, re-me it. *Additional Notes:* The pad should remain twelve hours after bei made before being used, and before being used should be sponged. T mixture should be strained through muslin to remove lumps of bariu sulphate. Care should be taken to avoid bubbles, which would cause uneven surface. If the writing is difficult to remove from the pad, h water may be used, though this causes the pad to wear away faster. is not necessary to remove all traces of the writing, as they will diffu themselves in the course of some hours in the slab. If the origin writing still shows a metallic lustre, it may be used to give anoth negative for printing from.—C. J. Watson.

Gleanings.

THE BRITISH ASSOCIATION commenced its forty-ninth annual meeting on Wednesday, August 20th, at Sheffield, under the presidency of Prof. G. J. Allman, M.D., LL.D., F.R.S., &c., who delivered the inaugural address, in which, as he himself described it, he gave "in as untechnical a form as possible, some account of the most generalised expression of living matter, and of the results of the more recent researches into its nature and phenomena." Our limited space precludes any attempt at even the briefest outline of this erudite and admirable address, a verbatim report of which is given in *Nature* for August 21st, to which we refer our readers. All we can do is to give very briefly the substance of a few of the introductory sentences.

SARCODE, as Professor Allman in this address pointed out, was the name given more than forty years ago by Dujardin to the structureless, semi-fluid, contractile substance of which the bodies of some of the lowest members of the animal kingdom consist.

PROTOPLASM.—Hugo von Mohl found a similar substance to sarcode occurring in the cells of plants which he was studying, to which he gave the name protoplasm. Max Schultze demonstrated that the sarcode of animals and the protoplasm of plants were identical. Subsequent researches have confirmed Max Schultze's conclusions, and it has further been rendered certain that protoplasm lies at the base of all the phenomena of life, whether in the animal or the vegetable kingdom. "Thus," says Professor Allman, "has arisen the most important and significant generalisation in the whole domain of biological science."

THE PHYSICAL BASIS OF LIFE, says Huxley, is protoplasm. Wherever there is life, from its lowest to its highest manifestations, there is protoplasm; wherever there is protoplasm, there, too, is life. Co-extensive with the whole of organic nature, it becomes to the biologist what the ether is to the physicist; only that instead of being a hypothetical conception accepted as a reality from its adequacy in the explanation of phenomena, it is a tangible and visible reality, which the chemist may analyse in his laboratory, the biologist scrutinise beneath his microscope and his dissecting needle.

THE CHEMICAL COMPOSITION of protoplasm is very complex and has not been exactly determined. It may, however, be stated that protoplasm is essentially a combination of albuminoid bodies and that its principal elements are therefore oxygen, carbon, hydrogen, and nitrogen. In its typical state it presents the condition of a semi-fluid substance—a tenacious, glairy liquid, with a consistence somewhat like that of the white of an unboiled egg.

MINUTE GRANULES are, under the highest powers of the microscope, frequently found disseminated in protoplasm in countless multitudes. Protoplasm may also be found to be absolutely homogeneous, and whether containing granules or not, it is certain that nothing will be found to which the term *organisation* can be applied.

BATHYBIUS HAECKELII is the name which Huxley gave to a peculiar slimy matter dredged in the North Atlantic by the naturalists of the exploring ship *Porcupine*, from a depth of from 5,000 to 25,000 feet. It is described as exhibiting, when examined on the spot, spontaneous movements, and as being endowed with life. Specimens preserved in spirits were subsequently examined by Huxley, and declared by him to consist of protoplasm, vast masses of which probably extend in a living state over wide areas of sea bottom. Haeckel has since subjected *Bathybius* to careful examination, and he believes he is able to confirm in

all points the conclusions of Huxley. The more recent investigations of the *Challenger* Expedition do not support these conclusions, but, as Professor Allman observes, "It is not easy to believe that the very elaborate investigations of Huxley and Haeckel can thus be disposed of."

PROTOBATHYBIUS is the name given by Bessels (one of the explorers of the more recent and ill-fated *Polaris* Expedition) to masses of living undifferentiated protoplasm dredged from the Greenland Seas; but they are in all essential particulars undistinguishable from the *Bathybius* of the *Porcupine* Expedition, and so far Bessels' observations confirm those above recorded.

PROTAMŒBA PRIMITIVA is a name given by Haeckel to "little protoplasmic lumps" found inhabiting the fresh waters in the neighbourhood of Jena. These, when placed under the microscope, were seen to have no constant shape, their outline being in a state of continual change, caused by the protrusion from various parts of their surface of broad lobes and thick finger-like projections (termed Pseudopodia,) which, after remaining visible for a time, would be withdrawn, to make their appearance again on some other part of the surface. They may be compared to minute detached pieces of *Bathybius*.

MONERA is the name given to a group, including several other beings as simple as *Protamœba*, described by various observers, and especially by Haeckel, who has given the name on account of the extreme simplicity of the beings included in it.

AMŒBA, a stage somewhat higher in the development of protoplasmic beings, was the next thing glanced at by Prof. Allman. Widely distributed in the fresh and salt waters of Britain, and probably of almost all parts of the world, *Amœbæ* are small particles of protoplasm closely resembling the *Protamœba* just described. Like it they have no definite shape, and are perpetually changing their form, throwing out and drawing in thick lobes and finger-like pseudopodia, in which their body seems to flow away over the field of the microscope. They are, however, no longer the homogeneous particle of protoplasm which forms the body of *Protamœba*. Towards the centre, a small globular mass of firmer protoplasm has become differentiated from the remainder, and forms what is known as a nucleus, while the protoplasm, forming the extreme outer boundary, differs slightly from the rest, being more transparent, destitute of granules, and apparently somewhat firmer than the interior. There is also a "contractile vacuole," a little rhythmically pulsating cavity of very frequent occurrence among those creatures which lie low down in the scale of life.

CELLS.—Although for 200 years the *Amœba* has been sought for in all likely places, and its Protean changes have never ceased to be a source of amazement, it is only the science of our own days which has revealed its biological importance, and shown that in this little soft, nucleated particle we have a body whose significance for the morphology and physiology of living beings cannot be over-estimated, for in *Amœba* we have the essential characters of a CELL, the morphological unit of organisation, the physiological source of specialised function.

BRITISH ASSOCIATION.—At a recent meeting of the Leicester Corporation it was unanimously resolved, on the motion of Alderman Barfoot, to invite the British Association to hold its annual meeting in Leicester at the earliest possible date. Leicester has never before been able to invite the Association for want of a sufficiently large room in which to hear the President's address; this need has now been supplied by the erection of the Royal Opera House. The invitation was, we understand, very favourably received by the Council of the British Association, so that after Swansea (1880,) with Professor Ramsay as President, and York (1881,) we expect an excellent meeting at Leicester in 1882.

DRIFT OF THE WEST MIDLANDS.—An important paper on this subject by Mr. D. Mackintosh, F.G.S., appears in No. 139 of "The Quarterly Journal of the Geological Society," just published. Three sources of boulders are indicated:—(1) Granite of Criffel, &c., in Kirkcudbrightshire; (2) Eskdale Granite and Felspathic Rocks, from the Lake District; (3) Felstones, &c., from the Arenig Mountains of North Wales. The agency of transport is believed to have been floating ice. On the south-west of the Clent Hills, between Hagley and Bromsgrove, and in less numbers near Birmingham, are many Arenig blocks; between Bridgnorth and Wolverhampton, and on Bushbury Hill enormous numbers of boulders (chiefly Criffel) occur. Here a warm current may have melted the bergs. The "great Cannon Hill Park boulder" at Birmingham, is referred to the Arenig area. In the discussion which followed the reading of the paper, Mr. J. F. Campbell instanced the Straits of Belleisle, almost in the same latitude, as a place where a similar state of things now existed.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—GEOLOGICAL SECTION.—July 22nd. Mr. W. Southall mentioned that the Reed Warbler (*Salicaria arundinacea*) had built in the reeds surrounding a pool at the back of his house, in Edgbaston. Mr. J. Morley exhibited some plants sent from Barmouth by Mr. J. W. Cotton. GENERAL MEETING.—July 29th. Messrs. Bolton and Levick exhibited a very remarkable animal found in Olton Reservoir by the members at the excursion thither on the previous Saturday, supposed to be the larva of some Entomostracon. Mr. J. Levick also exhibited *Ceratium cornutum*, a very curious Infusorian from the same place; also, *Conochilus volvox* and *Volvox globator*. Mr. J. E. Bagnall exhibited *Marchantia conica*, in fruit, from Sutton; and, on behalf of Mr. T. J. Slatter, *Monotropa hypopitys* and *Geranium pratense*, var. *album*. Mr. W. Graham exhibited a fine specimen of a supposed species of *Cycas* from the coal measures, Rowley. GENERAL MEETING.—August 5th. Mr. H. E. Forrest exhibited beautiful living specimens of the two Hydrozoa, *Campanularia verticillata* and *Halecium Halecinum*; also *Chiton cinereus*; all from Penmaenmawr. He also showed portions of the two first in the microscope, with the polyps expanded. Mr. Thos. Bolton exhibited *Doto coronata* and *Nymphon gracile* from the same place. Mr. W. R. Hughes exhibited some curious spawn from a pool near Hamstead, disposed in festooned chains. Mr. H. E. Forrest read a short paper on a supposed new Entomostracon, for which he proposed the name of *Daphnia Bairdii* (see page 217.) BIOLOGICAL SECTION.—August 12th. Mr. T. Bolton made a communication to the Section respecting a very beautiful and wonderfully-transparent Entomostracon, recently captured by members of the Birmingham Natural History and Microscopical Society at Olton Reservoir, which has been identified by Professor E. Ray Lankester as *Leptodora hyalina* of Lilljeborg, a species hitherto recorded as found in Sweden and Germany only. At the same meeting, Mr. Bolton exhibited the somewhat rare Entomostracon, *Polyphemus pediculus*, which occurs at the present time in enormous quantities, along with *Volvox globator*, in Sutton Park; also, *Ceratium (Peridinium) cornutum*, one of the Cilio-flagellate Infusoria, the elegant Diatom, *Campylodiscus spiralis*, &c. Messrs. Crick, Butterfield, and Caldwell contributed collections of local plants.

CARADOC FIELD CLUB.—Second Field Meeting of the Caradoc Field Club, at Welshpool, on Wednesday, July 30th. Visited Trilobite Dingle, and quarry of basaltic rock near the town. Some of the party walked to exposure of Bala beds at Moel-y-Garth; remainder to the top of Powis Castle Park, returning to Welshpool through the Castle gardens, &c. There was a large attendance of members.

NOTTINGHAM NATURALISTS' SOCIETY.—July 31st was set apart for the annual excursion of this Society, and the district chosen was that of Creswell Crags, to which, by the kind permission of the Duke of Portland, were added the Abbey and grounds of Welbeck. Creswell Crags are situated some half-mile from the village. They consist of a north and south cliff, the rocks in some places reaching sixty feet in height, and forming a picturesque defile in the local ridge of limestone through which flows the river Wollen, recently dammed up as a lake, a stream or shirebrook which parts Nottinghamshire from Derbyshire. At the foot of the northern cliff are two extensive caves, which, along with the one in the southern or Nottinghamshire cliff have recently been explored by the Rev. J. M. Mello, Chesterfield. Mr. L. Lee, honorary secretary of the Society, had arranged for the caverns to be illuminated. The Derbyshire portion of the caves was first examined. The lines of the recent floors were traced, and no small surprise was expressed at the great amount of *debris* which in the course of the explorations had been removed therefrom—*debris* which, as the prospectus of the excursion set out, contained remains of the cave lion, leopard, cave hyæna, machairodus, woolly rhinoceros, mammoth, wolf, grizzly bear, brown bear, bison, reindeer, and the Irish elk. The Nottinghamshire cave was also examined. At the mouth or entrance of this cave, amidst scenery which was classed by some of the members as the grandest they had ever seen, the company were favoured with a discourse upon the physical features of the district by Mr. William Stevenson, in the course of which he pointed out that the Creswell Caves were attributed to aqueous action, and were referred to one or more of the numerous submersions which the country has been subject to in recent geological times. With regard to the animals whose remains were found in the *debris* of these caverns, it was pointed out that the presence of fragments of bones was but poor evidence of the animals themselves inhabiting the caves, as their remains were found in the alluvium of the valleys and in the fractures and minor fissures of the rocks; but the evidence of their inhabiting the district was held to be incontestible. The oldest or extinct species pointed to convulsive actions of nature, in the form of mighty floods, where the bones of the animals themselves were gathered, along with the fragments of local and other rocks, and washed into these fissures or caves in the rocks, the preservation of the same being attributed to the calcareous nature of their surroundings. The lecturer dwelt at some length upon the explorations carried on in the Pleasley Valley by the Nottingham Naturalists' Society in 1865, and the additions thus made to the local museum, especially in the jaw of the *Felis lynx*, a carnivorous animal, no remains of which, with the exception of a solitary tooth in the British Museum, had previously been found in the deposits of this country, and he concluded by describing the Pleasley Caves as being analogous to those in the Creswell neighbourhood. The Society made another visit to the same locality on August 21st.

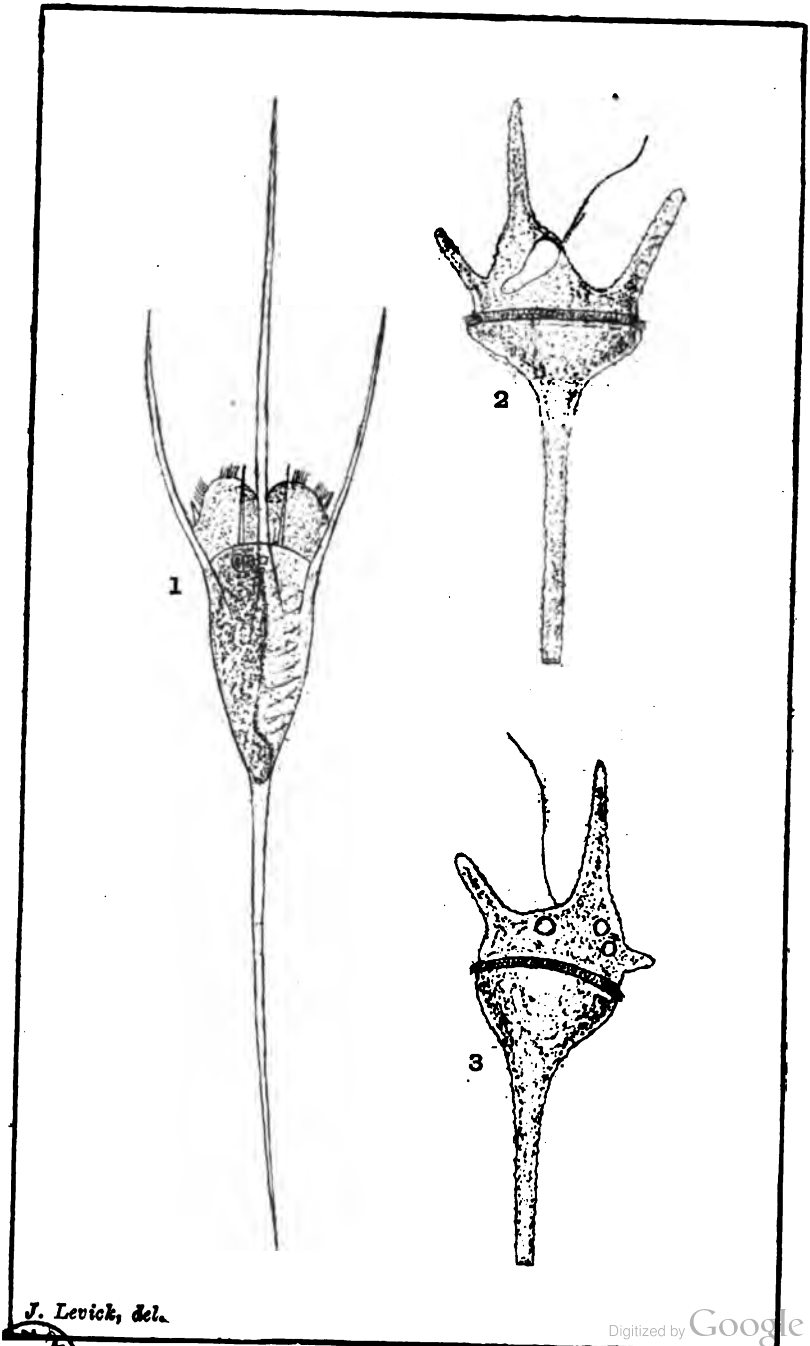
NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.—Excursions in July and August:—July 10th.—Excursion to Stoke-on-Trent, Trentham, and Longton. August 16th.—The second excursion of the season was to Dale Abbey. A party of members numbering nearly thirty went by train, at 2 30 P.M., to West Hallam, and walked thence to Dale. Heavy rain prevented anything from being done until after tea, when the party, under the guidance of Mr. Scott White, inspected the remains of the Abbey, which have recently been brought to light by the exertions of the Derbyshire Archæological Society, in excavations on the site of the Abbey. In the absence (through illness) of Mr. J. Charles Cox, a paper by Mr. Hope was read by Mr. White. From this it appears that the Abbey was founded in 1160, as a monastery of Austin Canons. About half the area of the Abbey buildings have been laid bare, consisting of a choir, with a double quasi-aisle to the south, central tower, nave, with north aisle, and north and south transepts, with a large chapel on the east of the north transept. After a close inspection of the Abbey, the monuments and encaustic tiles which are preserved in several sheds in the village were examined. For full particulars of these reference should be made to Mr. Hope's paper in the "Journal of the Derbyshire Archæological Society" for this year. The church and hermitage were afterwards visited, and the party returned to Nottingham at a late hour, *viâ* West Hallam.

OSWESTRY AND WELSHPOOL NATURALISTS' FIELD CLUB.—The third excursion for 1879 took place on July 31st. Meeting at Selattyn, the party took the way by the Tower, and along Offa's Dyke to Craignant, and then over the hill by Bronygarth to Brookside, where they were most hospitably entertained by Major Barnes. Some fine specimens of the Frog Orchis *(Habenaria viridis)* were found, and also Sweet Cicely *(Myrrhis odorata.)* The geologists found numerous fossils and fragments of fossils in the blocks of millstone grit on Selattyn Hill, and in the old limestone quarry at Yr Orsedd, by Offa's Dyke, were found some nicely preserved specimens of *Lithostrotion minus*, *L. floriforme*, *Alveolites*, and *Zaphrentis* among the corals, and good specimens of *Productus Youngianus* among the mollusca, together with numerous minute fossils, chiefly spines and stems of Eucrinites. After tea Mr. D. C. Davies, F.G.S., gave a short address on the principal objects of interest observed during the day. He explained the order of strata in the Ceiriog Valley, referring particularly to the carboniferous limestone and the millstone grit, along which principally the excursion had been made. The boulders of Scotch granite, seen on the top of Selattyn Hill, were also referred to in connection with the drift deposits. The address, which will probably appear in the proposed new volume of the Proceedings of the Society, concluded with a reference to the increased interest and beauty which a general knowledge of geology attaches to the extensive landscapes the excursionists had that day beheld.

STROUD NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.—August 7th, a short excursion was made (twenty-two members and friends present.) The meeting place was Frocester Court, where the old Tithe Barn of the Abbots of Gloucester was examined, and the fine timber work of the roof much admired. Mr. Chapman courteously received the visitors and admitted them to the Elizabethan Manor-house, built in 1554. Thence the members proceeded to Frocester Hill, where, under the President's guidance, the geologists made an examination of the bed of the Lower Oolite, rich in ammonites and belemnites. The botanists made search in the wooded slopes, and found some fine beds of *Polypodium vulgare*. The next point of interest was the long tumulus near Buckholt, which was uncovered some years since, exposing the various chambers. The construction was explained by Mr. Witchell. The excursionists then had, by Mr. Leigh's kind permission, a very pleasant walk through Woodchester Park, the beautiful scenery of which was much appreciated; on many of the lakes were water lilies in abundance and perfection. The botanists concluded their researches by an unsuccessful quest for clubmoss in the ferny hills, amidst bracken and thistle five feet high. The ramble was followed by tea at Theescombe House, where the members were most hospitably and kindly entertained by Mr. and Mrs. Charles Playne.

WOOLHOPE NATURALISTS' FIELD CLUB.—July 29th.—The third field meeting for the season was at Downton, on which occasion a goodly number of ladies, invited by special tickets, honoured the members with their presence. The day being fine, the drive over the beautiful hill of Mary Knoll was most enjoyable. Immediately under this hill is the wooded valley of Hay Park, where the Earl of Bridgewater's children lost themselves, and gave occasion to Milton to write "Comus." At Aston the members inspected the little Norman church, the Rev. J. H. Clay, the incumbent, explaining its interesting architectural features. At the Hay Mill the party left the carriages and wended their way through the beautiful and romantic scenery in the gorge of the river Teme to Downton, where many varieties of ferns flourish. On the bridge in front of the Castle a halt was made to collect the visitors together. The private grounds and conservatories were then visited, and under a wide-spreading beech tree the President took the chair, and the business of the club was transacted. The President read an interesting paper written by Mr. Timothy Curley on the "Monastic Remains Discovered in the Construction of the Ludlow Cattle Markets," for which a cordial vote of thanks was passed. The beautiful grounds and the chief rooms in the Castle were kindly thrown open to the members and their friends. The return journey was made through Oakley Park (the seat of Lord Windsor) to Ludlow, where a meat tea was provided at the Feathers Hotel. The Museum at Ludlow was visited by some of the members, who expressed themselves highly gratified by the excellent taste displayed in the arrangement of the valuable collection by Mr. Charles Fortey.

Plate VI.



A New Rotifer. &c.

A NEW ROTIFER.

BY J. LEVICK.

In July last a visit was made to Olton Reservoir by a few members of the Birmingham Natural History and Microscopical Society, when I had the good fortune to find that curious Entomostracan, since proved to be *Leptodora hyalina*, a description and figure of which are given at page 225. This species had been discovered before only in Sweden and Germany.

Upon carefully examining the contents of my bottles under the microscope, I noted other rare things, and became very desirous of hunting again in the same locality.

By the kind courtesy of our esteemed member, Mr. C. T. Parsons, I have been able to revisit the pool, which is private property, upon several occasions, and have now the pleasure of recording the discovery of a most strange-looking Rotifer, (Plate VI., Fig. 1,) which is new to this country, and has only most recently been known even to science, and to which I had given the provisional name of *Anuræa tricornuta.*

I sent a sketch and mounted specimens to Dr. C. T. Hudson, to whom I am much indebted for his kind aid, and who expressed his belief that my Rotifer was the same creature as one discovered in Niagara water by Professor D. S. Kellicott, of Buffalo, U.S., who gave a description and figure in the "Journal of the Royal Microscopical Society" of April last, under the proposed name of *Anuræa longispina.*

Notwithstanding that I am unable to make my Rotifer agree with the Professor's details and drawing in some important points, the general characters are so nearly alike that I have no doubt our Rotifers are identical. I must refer your readers to the before-named publication for his account of it, and will here give only such particulars as I have been able to make out in the short time the Rotifer has been under my observation.

As seen in the microscope it is a formidable-looking creature, and may be compared to a three-pronged fork with a handle. Its extreme length is about 1-40th of an inch; it has a hard glassy lorica, which reflects light nearly as brilliantly as does the silicious epiderm of a diatom; it has four spines, three anterior and one posterior, the former roughened or serrated the whole length, the latter only towards the end; the long frontal spine is straight, starting from the upper terminal edge of the carapace, those at the angles curved outwards and downwards; the posterior spine is also slightly curved, all being perfectly rigid, having no hinges or joints.

A reference to my sketch (Plate VI., Fig. 1) will give a better idea of the form of the lorica than I can do in words, but it is described by the Professor as "ovate-cuneate;" it is convex on the dorsal and somewhat

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REFERENCES TO PLATE VI.

Fig. 1.—New Rotifer, *Anuræa longispina*, × 240 diameters.
Fig. 2.—*Ceratium longicorne* (?) × 300 diameters; from Olton.
Fig. 3.—*Ceratium longicorne* (?) × 300 diameters from Sutton Park.

hollowed on the ventral side, the hollow deepening towards the posterior end, where the female carries the egg attached.

It has one round red eye, centrally situate, level with the base of the long frontal spine, and viewed from the ventral side the mastax is seen a little to the left, working away in the usual manner, having I believe four pairs of teeth upon which its prey is continually falling.

Curiously enough in the first specimens gathered the eye-spots were two, nearly close together, both round and red, and of equal size; but in those since taken, evidently in a more advanced stage, many of them carrying the egg, one eye only appears, much larger, but in other respects the same. This phenomenon is new to me in Rotifer life, and I have carefully preserved mounted specimens showing both characteristics. It is common enough in some species for the eyes to disappear altogether; but this is the first instance I have met with in which two small spots, apparently, coalesce and form one larger eye.

The trochal lobes, as shown in the sketch, commencing with the two central short horns, are more protruded than is usual when the creature is swimming, the specimen figured being held under slight pressure; they are furnished with six small tufts of cilia, which under a low power appear almost continuous, and are protected by four short horns, which, unlike the long spines, will bend inwards.

The capacious stomach is of very simple form, looking like a long sack. It occupies about one-half the enclosed space, starting from the gizzard, passing down the left side, and forming a constriction towards the end, and in the specimen now under examination a rhythmical expansion and contraction is continuously taking place.

Professor Kellicott figures a pair of well-defined "wheels" which are not to be seen in my Rotifers, and are probably a mistake.

Like its congeners, it is heavily weighted with its case, and its power of propulsion is comparatively slight. It swims either forwards or backwards at about the same speed, and appears to prefer deep water for its habitat, being most abundant from three to five feet below the surface, in a part of the pool free from plants or mud; it lives but a short time after being gathered.

Its companions at Olton were two other forms of *Anuræa*, viz., *A. aculeata* and *A. stipitata*, with several species of *Peridiniæa*, either with or without horns, the form I have sketched at Fig. 2 being the most abundant. This bizarre-looking creature, about 1-100th of an inch in extreme length, (possibly the *Ceratium longicorne* of Perty,) is new to me in fresh-water life, the horned species of Peridinium being usually found only in salt water; it belongs to that order of ciliated organisms which are besides furnished with one or more flagella, and therefore named cilio-flagellata.

Its congeners are well-known among the marine forms of phosphorescent protozoa, and its outline will be recognised as not unlike some of the species found at Arran last year, when the microscopists of the Marine Excursion party were busy seeking Noctiluca. It is of a yellowish green colour, has a rough and apparently calcareous carapace, which is

deeply marked with hexagonal areolæ; a ciliated furrow or groove passes round the widest part, and it is besides furnished with a long flagellum, starting from the base of the central frontal horn, where is to be seen a bright clear space, of an irregular oval shape, probably a vesicle, though I have observed no contraction nor any signs of its purpose. It swims either forwards or backwards, with a rolling motion.

Fig. 3 is a somewhat different form, taken at Sutton Park last June, and figured by my friend Mr. H. E. Forrest, which had, besides a vesicle more centrally situate, three very distinct red spots, which in some analogous species have been variously set down as eyes or eggs, and upon which I am unable to throw any light.

ON THE ROCKS OF BRAZIL WOOD, CHARNWOOD FOREST.

BY S. ALLPORT, F.G.S., AND W. JEROME HARRISON, F.G.S.

This geologically interesting locality has already been briefly described in the pages of this magazine (Vol. II., p. 119,) and the occurrence of garnets in the "gneiss" noted (p. 77.) Quite recently, a microscopical examination of the so-called gneiss convinced one of us that it was an excellent example of contact-metamorphism, similar in character to that observed round the margins of large masses of granite. A visit to the wood was at once made, and the result of a few hours' work was the collection of two heavy bags of specimens, and an interesting addition to the known geological facts of the district.

Brazil Wood lies on the east side of Charnwood Forest, between the villages of Swithland and Mount Sorrel. It is in a valley occupied by the Keuper Red Marls, which cover over the intervening space between the slate quarries of Swithland and the great granitic mass of Buddon Wood and Mount Sorrel. Only in Brazil Wood do we get any indication of the line of junction of the slaty and granitic masses, this line being everywhere else covered over and concealed by the red marls. The wood is about one hour's walk (three miles in a straight line) from Sileby Station, on the Midland main line.

In the field next to the wood on its north-west side there is a small knoll of diorite, which is distant only about 100 yards from the granite, and the latter appears to be connected with the Buddon Wood mass by an exposure at Kinchley Hill, half-way between.

Entering Brazil Wood from the direction of Mount Sorrel, we see on the left hand (north-east portion of wood) a small conical hill of granite, about 750 yards in circumference at the base, and rising from 70ft. to 100ft. above the surface; on the right hand (south-west part of wood) is a smaller knoll of a rock which has hitherto been called "gneiss." On the western side of the granitic mass on the lower edge of a very small

quarry, is a dyke of diorite, first noted by the Messrs. Hill and Bonney. ("Quarterly Journal of Geological Society," Vol. XXXIV., p. 223.)

The rock forming the conical hill has the same mineral constitution as that of the larger granitic masses above mentioned, although it differs from them in appearance. It is a rather fine-grained hornblendic granite, having all the constituents well crystallised, and in a remarkably fresh state of preservation. It may be regarded as a good typical example of this variety of granite, and forms a very beautiful preparation for the microscope.

The so-called gneiss is almost wanting in two of the essential characters of that rock; it contains scarcely a trace of felspar, and the foliation is very imperfect. The only recognisable minerals are mica and quartz, and as the mass of the rock is rather fissile in one direction, it might be called a micaceous schist, in order to distinguish it from the typical mica schists, from which it differs in some respects. These rocks will be more fully described hereafter.

The knoll of "gneiss" is separated from the granite by an interval of 35 yards, and this depression is occupied by soil and vegetation, so that the main junction of the two great masses of igneous and aqueous rock cannot be observed. Masses of a dioritic rock have been found on the surface of this interval or passage both by ourselves and Messrs. Hill and Bonney, and the relation of the three sets of rock (viz., the granite, "gneiss," and diorite) to each other has hitherto been a matter on which nothing certain was known.

By observations recently made we are enabled to prove that the granite is clearly intrusive in the "gneiss," and that the latter rock is probably the result of the alteration of clay-slates belonging to the Forest series.

An opening has been made in the "gneiss;" it has been worked back 25 yards from the edge nearest the granite, so as to expose a "face" 50ft. in width and 33ft. in height. It is worked for road metal for the immediate vicinity, and a large heap of broken stone usually lies on the floor of the quarry. On the "face" the remarkable contortions of the rock at once attract attention, those in the south-west corner being very abrupt and "diagrammatic." The mass of the stone is of a dark-purplish hue; the broken surfaces glitter with flakes of mica; it is excessively tough and much jointed, the joints being frequently curved and showing marks of slickensides.

In the north-west corner of the quarry (where excavations have recently been made) we noted a rock of very different character to the "gneiss" above described. Here, underneath a tree, whose roots penetrated its yielding substance, we found a mass of decomposed granite, 5ft. in width. As this passes downwards it sends off narrower veins into the gneiss, which reach nearly to the floor of the quarry; but the main granitic vein turns southwards and enters the face of the quarry, enclosing here a lenticular piece of the metamorphic rock, which measured

3ft. by 2ft. On examining the opposite or south end of the quarry, we here also found veins of granite running up the face and overlying the contortions before mentioned, and further small veins penetrating the rock even in the very centre of the quarry. At some points the line of junction of the two rocks was sharp and distinct, but at others the two appeared to be blended together for at least a few inches. Near the junction innumerable garnets were found to be developed in the gneiss, and a few occur also in the granite. Some of them exceed one-eighth of an inch in diameter, and are finely crystallised.

At the north end of the pit we noticed, embedded as it were in the "gneiss," four distinct patches of a bedded rock, resembling an altered ashy slate. These occurred one above the other at intervals of two or three feet, and had a north-westerly strike. These may be portions of a band of rock interbedded with the gneiss, and "pinched" by it during the contortions which it has undergone. They reminded one of us of the banded ashy Charnwood slates.

Ascending to the top of the knoll of gneiss we find a ridge 30 yards long, running N.N.W. by S.S.E. The northern end has been quarried into, but at the southern extremity we found an exposure of granite which is probably *in situ*, and represents the outcrop of another vein striking through the gneiss. The knoll is thickly covered with vegetation, and many of the rocks are overlaid by a considerable thickness of moss; but we found a little cliff running along the S.W. side, which proved to be composed of a rock having a distinct cleavage, and to have the characters of an altered and slightly indurated clay-slate; it contains numerous small garnets. The cleavage is nearly vertical, and runs N.W. and S.E.; the strike, as far as we could detect, is a few degrees more to the west. This slaty rock is interbedded with a more compact and less cleaved bed.

The discovery of these slaty rocks is another point of interest, as none have been previously observed to the east of the Swithland slates. The strike of the beds and their general appearance renders it almost certain that they belong to the Charnwood series, and we attribute their present crystalline structure to the action of the intrusive granite.

We thus have in this small area an excellent example of the junction of igneous with aqueous rocks, and of the gradual change produced in the latter as they approach the injected mass. It is at present the only good, well-exposed, and readily accessible example with which we are acquainted in this district, for the line of junction in this area seems to be generally also a line of weakness, along which the rocks are shattered, so that they have readily decayed and left a hollow which is usually filled with soil; it is so, indeed, in this case, but the numerous veins sent forth from the granitic mass can here be clearly traced invading and altering the aqueous rock.

These various rocks present several other points of interest, and their microscopical investigation has been undertaken by one of us, the results of whose work will probably appear in a future number.

THE ARTIFICIAL SEA-WATER AT THE ASTON AQUARIUM.*

BY WILLIAM SOUTHALL, F.L.S.

To Philip Henry Gosse, the eminently well-known Naturalist, who, with his pen and pencil, has made so many of us familiar with the wondrous beauty of the inhabitants of the sea, belongs the credit of the introduction of the Marine Aquarium. In the second edition of his excellent book, "The Aquarium," published in 1856, he gave the world the benefit of his thoughts and experiments, by publishing a formula for producing easily and cheaply a supply of artificial sea-water such as had been found sufficient for the purposes of small aquaria. Many other formulæ have since been suggested, and nearly all, like that of Gosse, have been based on the analysis of Brighton sea-water, published by Dr. Schweitzer in the "Philosophical Magazine" for July, 1839. However much such made-up water has answered the purposes required, *theoretically* it has been at fault, inasmuch as in chemical composition it has not been identical with real sea-water, and on this account, perhaps, many Naturalists have been unable to keep certain animals alive in such water, and have affirmed that made-up sea-water is so lacking in certain elements or properties as to be unfit for the maintenance of marine animals in a state of health. Opinions being thus divided, the boldness of the directors of the Aston Lower Grounds Company, in deciding to use none other than artificial sea-water in their magnificent Aquarium, is to be admired; and Naturalists all over the country are looking with interest upon the scheme now carried out for the first time in England on a really great scale. The following tabular statement of the composition of the concocted sea-water may, therefore, be deemed interesting. In the first place, it may be stated that the fine series of tanks and the underground reservoirs are capable of holding, in the aggregate, 300,000 gallons, and sufficient water has been made to fill the whole of the show and reserved tanks, and to nearly fill the reservoirs, enough space only being left to accommodate the contents of a few tanks in case leakages should occur. My firm (Southall Bros. and Barclay) was appointed to manufacture the water, and about fifty tons of chemical substances have been used. Each ingredient was subjected to analysis, and allowance made in every case for water of crystallisation, hygroscopic moisture and impurities, and the various constituents of the well-water used were also allowed for in calculating the working formula. The analysis of Dr. Schweitzer was taken as a basis, supplemented by our own analysis of water recently taken near Brighton, a mile from the shore; and from the latter the data necessary for the required amounts of iodine, &c., were obtained. As a result, the water in use in the Aquarium contains the following

* Read before the Birmingham Natural History and Microscopical Society September 23rd, 1879.

compounds in solution, and in the proportions given, from which it will be seen to completely represent chemically real sea-water:—

	Grains per Gal.
Sodium chloride	1894·1
Potassium chloride	53·6
Magnesium chloride	256·6
Magnesium bromide	2·0
Magnesium sulphate	160·7
Calcium sulphate	98·4
Calcium carbonate	5·8
Magnesium carbonate	1·5
Magnesium nitrate	0·3
Sodium nitrate	0·2
Oxide of Iron	0·1
Silica	1·0
Iodide of Sodium	traces.
Ammoniacal salts and organic matter	slight traces.

For the thorough admixture of the water in the various tanks, and the preparation and filtration of solutions, a considerable length of time was required; and it is only at the present date that the water is assuming what may be termed its permanent and representative character. Time will prove how far the sanguine anticipations of its promoters will be realised; so far it is certain that all animals hitherto placed in the tanks, under fair conditions, have done exceedingly well.

A FESTIVAL OF GNATS.

BY F. T. MOTT, F.R.G.S.

On the evening of September 1st, between six and seven, after a fine, sunny day, the sky being clear, and the full moon just rising as the sun went down, there was a grand festival among the gnats. Above the tops of trees and hedgerows in the low meadows north of Leicester these little Diptera were out in immense numbers. I calculated that there might be about three millions of them to a mile of hedgerow. They assembled in groups of various shapes, sometimes a vertical column from 6ft. to 20ft. high, and 1ft. to 3ft. diameter, rose from a tree top like a pillar of smoke. Sometimes a sheet 4ft. or 5ft. high and 10ft. long hung above the hedgerow, but seemed never more than a foot or so in thickness. The following evening, at the same hour, the sky being more clouded, a few gnats only were to be seen; but on the evening of the 6th, with the sky again cloudy, there was a still more remarkable display of gnat life. The little creatures were out again in millions, but this time the vertical column formation was adopted by nearly the whole of them. These columns rose from the hedges on either side of the road, and were visible for half a mile a-head at irregular distances, averaging, perhaps, 12ft. or 15ft. They formed an avenue of such a singular and unusual appearance that everyone who passed along the road paused at intervals to watch and wonder at them. This piece of road is about half a mile long, on the top of an embankment which carries it over the low meadows and the river. At the farther end there are a number of trees, and from the top of nearly every tree three or four of the strange, smoke-like columns could be seen standing up in the air, always straight but not always vertical, some of them being inclined at small angles. It was altogether a very curious sight. It has not occurred again, and I do not remember to have seen anything like it before.

On watching one of the columns closely, it was apparent that all the gnats had their heads one way, facing the breeze, which, however, was a very light one. It was a calm evening; what air-current there was came from the south-east. It seemed to be sufficient occasionally to press back the column a few inches from its normal position, and whenever this happened the whole body of gnats jerked themselves forward again with one perfectly synchronous impulse. How this was accomplished it is difficult to understand. But in fact their whole manœuvres were mysterious, and suggested a variety of questions.

What do these little creatures do during the day, and what do they feed upon?

What was the object of their evening exercises? They were in constant motion, but seemed never to jostle one another.

Why on that particular night did they arrange themselves in vertical columns, with such a general uniformity of shape and size?

How, in their rapid and perpetual motion, were they able to maintain their formation with such precision that at a short distance the columns seemed quite stationary?

How did they contrive to keep such perfect time in their sudden leaps against the wind?

Many of the phenomena of insect life seem to suggest that these little animals have some sense—perhaps several senses—quite unknown to us vertebrates. May there not be other "gateways of knowledge" besides the five by which it enters our fortified brains? Why not an electric sense, which should vibrate to electric currents, as the ear to sound or the eye to light?

AN EXCURSION TO FROGHALL, CALDON LOW, AND ALTON.*

BY JAMES SHIPMAN.

It was seven o'clock in the morning of the 5th of last October, and a somewhat cheerless grey mist hung low overhead, as a small party of the Natural Science Section of the Nottingham Literary and Philosophical Society steamed out of the Midland Station on a visit to the famous ironworks at Froghall, the limestone quarries at Caldon Low, and to lovely Alton—the last geological excursion of the season. Anyone but the most astute meteorologist, and one conversant with the sudden atmospherical changes of the last two years, would have predicted something more substantial than mist. As it was, however, we were all destined to be agreeably surprised by the bright day that was in store for us. The charmingly picturesque valley of the Churnet about Alton, up which we glided as we approached our destination, was not seen to much advantage under the circumstances. But there was still the steep

* Read before the Natural Science Section of the Nottingham Literary and Philosophical Society, Dec. 20th, 1878.

slope of Bunter Pebble Beds on either hand, with strips of the sombre crimson, but mostly mossy and variegated, conglomerate peeping here and there from between the clustering ferns and wild flowers and foliage that almost clothe them; while above, rising abruptly into a perpendicular craggy cliff from the top of the Bunter slopes, could be seen the massive white and pink sandstone of the Lower Keuper, like a thick bed of basalt, capping the hills all round.

We alighted a little after nine at the Froghall Station, where we were met by Mr. Fraser, the manager of the Caldon limeworks, and, having refreshed, we walked on to the wharf, about half a mile distant, along a valley formed by the junction of a small stream descending from the limestone country to the north with the Churnet. We had left the terraced hills of the Triassic Rocks, and were now fairly on the Lower Coal Measures or Gannister Rocks, which in our front, over to the north and west, rose into bold dimpled hills crowned with thick tufts of pine, rather characteristic of the Lower Coal Measures. Beyond lay the picturesque Millstone Grit, rising sharply from the almost featureless Yoredales, while perhaps the Carboniferous Limestone of the Weaver Hills formed the shadows which filled the background. The Cheadle coalfield, across the eastern edge of which our path lay, is about 1,000ft. thick, and forms one of those "basins" into which the Coal Measures of North Staffordshire have been thrown on the west, called the Goyt Trough.

The ironstone, for which the Gannister Rocks at Froghall have long been famous, was stored at the wharf in banks about 20ft. high, broken up into slabs, and separated into different qualities ready for transit to the smelting furnace. The hematite is of the usual dark-brown or blackish colour, being streaked with light-brown along the planes of bedding, giving it somewhat of a stratified appearance, the joints being mostly filled with calcite.* Some geodes in this ironstone yielded very minute six-sided prisms of calcspar. The ironstone is usually found associated with dark, chocolate-coloured shales, and rests on from 1ft. to 14ft. of gray or reddish slaty clay, forming the lowest bed of the Gannister series in this district. It varies in thickness from 1in. to 22in. A remarkable feature connected with this ironstone is that it is only found developed in what seem to have originally been "basins," between saddles or folds of the already crumpled Millstone Grit; for over the more elevated underground ridges of the grit it is found to be represented by a mere trace of reddish ochre. The shales below it present similar phenomena.

Froghall is also the terminus of the tramway from the Caldon Low limestone quarries, and here was the machinery for crushing the stone

* An analysis of this ore, given in "The Iron Ores of North Staffordshire," shows that this hematite consists of :—

Peroxide of iron	52·83	Sulphuric acid	0·28
Protoxide of manganese	0·81	Silica	trace
Lime	14·61	Water	4·75
Magnesia	5 70	Organic matter	1·30
Carbonic acid	18·14		
Phosphoric acid	0·32	Total amount of iron	36·98

into road-metal. The process being similar to that in use in other localities, however, it need not be described. Lying about among the limestone, were some massive geodes, where the prisms of calcite were four or five inches long; and although very interesting as mineralogical specimens, they seemed to be regarded as refuse here. A fine red clay, brought down in large quantities in the trucks from the limestone quarry, was evidently of some commercial value, for the women as well as men connected with the canal boats were actively engaged in taking a cargo of it on board. It somewhat puzzled us to know what formation it could have been derived from. Among other things we learnt here that the limestone, of which there were such stores all round, contained too much iron to be useful for agriculture, but that it made the best of fluxes for smelting.

Taking our seats in a specially prepared tram-wagon, we soon found ourselves gliding, without any visible motive power, up a gentle incline cut through the dark gray shales of the Lower Coal Measures. Meanwhile the curtain of dark clouds and haze which had hitherto given an air of cold solemnity to the excursion now swept swiftly across the sky, and with bright sunshine and the bluest of blue skies overhead, and amid charming scenery, almost romantic, we were presently making our way along one of the spurs of high ground that stretch from the Weaver Hills down to Froghall.

We "pulled up" at Oldridge to examine a curious pillar, or "needle," of what seemed to be the Third Grit (of the Survey) resting on the shoulder of the ridge along which the tramway passed. The ground around was smooth and grass-grown, sloping rather steeply into an east-and-west valley, which widened out to the west. The "needle" itself was about 25ft. high, in some parts being as perpendicular as if it had been chiselled by hand, and about 12ft. in diameter. It consisted of reddish-brown grit with quartz pebbles, and showed distinct oblique lamination, in one face inclined at 45° to south-west. It was difficult, even on the spot, to come to any fair conclusion as to the exact process by which the pillar got formed, for there was no exposure near with which to compare it, and time was too short to examine the hill around. We know, however, that the Third Grit is usually massive and well-jointed, and the fine edges formed by its outcrop are among the most noticeable features in the scenery of this part of Staffordshire. It may be inferred, then, that this columnar mass represents the ruins of an ancient "edge" or cliff, produced partly by the scooping out of the east-and-west valley—the lower part of which is probably in the Yoredale formation—and partly due to the physical structure of the grit of which it is composed. Similar pillars are met with at Belmont Chapel on the north side of the Cheadle coalfield.

Partly owing to faults and partly to the general outcrop of older rocks going west, the sections exposed by the line revealed a complex alternation of Yoredale rocks, Millstone Grit, and Carboniferous Limestone, and at one point we passed through a tunnel in the Yoredale rocks, 500 yards long. We were soon in sight of Caldon Low, a flattened mound of limestone on the western edge of the Weaver Hills, which rose

in graceful treeless but grassy swells from the sterile-looking stretch of Yoredale shales. The limestone quarry is about 500 yards long and 140ft. high; and we learnt that there was a similar quarry on the other side of the hill. Gunpowder is preferred here to dynamite for bringing down the rock on account of its greater economy, dynamite being too swift and not lifting so efficiently. We had a good opportunity of observing the action of gunpowder, as several "shots" were fired while we were examining the limestone and the curious veins of calcspar which traverse it in every direction. It had been arranged, however, that an unusually heavy shot should be prepared against our visit; so we devoted the time still required to complete its preparation to examining the crescent-shaped quarry. At the south-eastern horn of the quarry there was what appeared to be a fault, bearing N.N.E., and the space between the walls of the fissure (about 8ft.) was filled with subangular pieces of limestone coated with radiate prisms of calcspar half an inch long, and also contained hematite; the whole being imbedded in red clay cemented by carbonate of lime—the same red clay, in fact, as we had seen earlier in the day at the wharf. Everything being ready for the great shot, we took up position among the rocks at the other end of the cliff, whence the cavern containing the powder could be seen, about 400 yards off. Eighteen hundredweight of powder was used for the charge, and it exploded with a stupendous reverberating roar, lasting about ten seconds, and accompanied by the rattle of thousands of tons of rock as a large area of the cliff crumbled down into the quarry.

Behind the rocks on which we stood was a gap, or "pocket," in the cliff, about 30ft. deep, and as many wide, reminding one of an abandoned lode working. It was an old disused clay pit, and once contained one of those remarkable deposits of white clay and sand which have been observed in several spots on the Weaver Hills, in Wales, and in Ireland.* Mr. Binney, F.R.S., who saw the "pocket" in its best days, says it was filled with bluish-white and pink clay, with various coloured sands, and strings of quartz pebbles, in lenticular alternations, curving inwards towards the middle. The middle of the deposit was occupied by a vertical bed or "pipe" of rounded pieces of grit and white quartz pebbles, mixed with sand, about 5ft. wide; and Mr. Binney regards this as proof that the "whole of the clay and sand now found in the hollow of the limestone was the *débris* of the Millstone Grit formerly lying above them," though he quaintly adds, that "there must have been some strange commotion to account for the position of the pebbles." There was little to be seen of the clay now, however, as the middle of the deposit had been scooped out, and the Drift capping from above had almost completely obscured what remained. One of us here chanced to pick up a boulder of greenstone in the Drift. It most resembled one of the Derbyshire "toadstones," though it could scarcely have become so well rounded during the Glacial Period, and was most likely washed out of the Millstone Grit, during which period it was probably broken off its parent rock, and worn into a boulder. We saw no fossils here.

* See papers by Mr. G. Maw, F.G.S., "Geological Magazine," 1866.

As the afternoon was advancing we left Caldon Low, and with it our estimable *cicerone*, Mr. Fraser, whose courtesy, information, and arrangements left nothing to be desired, and striking across the country to the south-east, presently descended into the embouchure of a ravine in the limestone, with the slopes of Wardlow rising to above 1,000ft. on the left and a much lower ridge on the right. Our path was dotted on either side by old clay pits about 20ft. deep. These showed that the bottom of this valley was filled with deposits of white clay, covered with a thick deposit of red Drift sand and pebbles. The water at the bottom of the pits, however, prevented any examination of their steep sides; and there was no halt till we got to the Ribdin pit, about a mile south of Caldon Low. Here was a very extensive opening, about 40ft. deep, in the white clay deposits, forming the western slope of the valley, where it had widened out somewhat. The section revealed about 30ft. of white and yellow fine tough clay, with irregular patches and broad bands of well rounded quartz pebbles, and large angular blocks of Millstone Grit, Lower Keuper pebbly sandstone, and occasional rounded boulders of chert. Neither contortion nor bedding could be made out; but irregular masses of yellow clay or pink sandy clay reared themselves up in the midst of white clay in the most perplexing manner; yet the deposits had evidently been very slowly accumulated, and were capped with a thick deposit of Drift. Many of the blocks embedded in the clay had so far decomposed as to preserve only their original outline and sandy texture, but were as soft as the clayey matrix; others had altogether melted into the clay and given it a pink tint. Curiously enough there were no traces of limestone among the *débris*. These argillaceous deposits are said to extend more or less over a stretch of nearly two miles from north-west to south-east, but the rock on which they rest could not be seen, though it is mapped as Carboniferous Limestone. They occupy a position about 1,000ft. above the sea. Similar deposits have been met with in North Wales and in Tipperary, at heights of from 800ft. to 1,000ft., mostly in deep cavities in the Carboniferous Limestone, and always below the Drift. They may not all be of the same age, but in nearly every case the same mineral characters are found associated—soft chert breccias, white and buff clays, dark laminated clays, and carbonaceous beds. The cavities in which these deposits occur appear to have been formed after the manner of sand pipes in the Chalk—by the slow dissolution of the limestone, into which the superincumbent beds of grit or sandstone appear to have gradually subsided.

It was difficult to tear ourselves away from so interesting a spot, for there was sufficient here alone to furnish a good day's work. Regaining the main road, however, near Three Lows, we kept the ridge of Yoredale, capped at intervals by Millstone Grit, on to Farley. The scenery was exceedingly pretty all the way, but as we descended into the valley of the Churnet, at Alton, it became magnificent. It was now too late to examine any of the fine exposures of the Lower Keuper at Alton, so that a very agreeable lunch at the "Shrewsbury" terminated a capital day's labours.

THE CRYPTOGAMIC FLORA OF WARWICKSHIRE.

BY JAMES E. BAGNALL.

(Continued from page 224.)

BRUCHIACEÆ.

92.—*Archidium phascoides* Brid. Moist heaths. Edgbaston, (Cameron !) Shores of Coleshill Pool ! April, 1868 and 1871. Very rare. April.

93.—*Pleuridium nitidum* Hedw. *Phascum nitidum* Wils., Hobk. Local, but probably frequently overlooked. Moist banks, damp sandy and marly fields. Shirley ! on banks near Earlswood Reservoir ! field by Powell's Pool, Sutton Park ! Autumn, Spring.

94.—*P. subulatum* L. *Phascum subulatum* Wils., Hobk. Banks and fields, frequent; Acocks Green Railway bank ! Olton ! Packwood ! wood near Maxtoke Priory ! fields in Tythall Lane, Solihull ! Oversley Wood ! Sutton Park, 1879 ! Spring.

95.—*P. alternifolium* B. and S. *Phascum alternifolium* Wils., Hobk. Banks and fallow ground, rare or overlooked. In fields near railway station, Marston Green ! Old clay pit, near Erdington railway station on banks ! Spring.

LEUCOBRYACEÆ.

96.—*Leucobryum glaucum* L. Moist heathlands and heathy bogs, local. In many parts of Sutton Park ! but always barren. Coleshill bog !

POTTIACEÆ.

109.—*Sphærangium muticum* Schreb. *Phascum muticum* Wils., Hobk. Moist banks and fallow fields, local. In sandy fields Coleshill Heath ! Tile House Green, near Knowle ! Fields by Powell's Pool, Sutton Park ! Autumn, Spring.

111.—*Phascum cuspidatum* Schreb. Moist banks and fields, common. Coleshill Heath ! Solihull ! Canal bank, Acocks Green ! Sutton Park ! &c. March.

Var. e. curvisetum *Dicks*. Fields, rare. Sparingly in a fallow field above Coleshill Pool, March, 1869 !

115.—*Pottia minutula* Schwg. Marly and sandy fields, not rare. Fields near Shirley ! Solihull ! Acocks Green ! Sheldon ! Red Hill ! Bearley ! Hartshill ! Astley ! Maxtoke ! Winter and Spring.

116.—*P. truncata* L. Fallow fields, banks, heathy footways, very frequent. Acocks Green ! Sutton Park ! Kingswood ! Autumn, Spring.

117.—*P. intermedia* Turn. *Pottia truncata, b. major* Wils., Hobk. Fields and walls, not rare. Fields near Westwood Coppice, Sutton Park ! Acocks Green ! Exhall, on marly banks ! Bearley ! Shirley ! Kingswood ! marly banks near Henley-in-Arden ! stone quarries, Hartshill ! wall tops by Arley Hall ! Spring. Mr. Mitten considers this to be a variety of *P. lanceolata*. "Journal of Botany," IX., 1871.

118.—[*P. Wilsoni* Hook. Banks in a sandy soil. This species has been found by Mr. E. W. Badger, jun., at Moseley, Worcestershire, on banks, and may probably be found in Warwickshire.]

123.—*P. lanceolata* Dicks. *Anacalypta lanceolata* Wils., Berk., Hobk. Marly banks, wall tops in lias soils, &c. Plentiful on banks Chesterton Wood ! Tythall Lane, Solihull ! Lias wall tops at Harbury ! Kineton ! Fenny Compton ! Edge Hills ! Canal bank near Bearley ! growing with *P. intermedia*, at Arley Wood ! March.

128.—*Didymodon rubellus* B. and S. Walls and banks, frequent. Shortwood Coppice! walls of Kenilworth Castle! Sutton Park! Canal bridges between Olton and Knowle! Kineton, on lias walls! Arley! Hartshill! Erdington, old clay pits! October.

132.—*D. sinuosus* Wils. *Tortula sinuosa* Hobk. Walls and tree roots, rare. On wall of bridge near Henley-in-Arden! On roots of tree stump just outside Fenny Compton! very abundant on railway bridge in road from Birdingbury to Norton, 1878! Always barren.

137.—*Ditrichum flexicaule* Schwg. *Trichostomum flexicaule* Wils., Hobk. *Leptotrichum flexicaule* Berk. On marly banks, very rare. Abundant on marly bank, at Marl Cliff, just within the county! Barren.

141.—*Trichostomum tophaceum* Brid. Walls and clay banks, local. Dam of Bracebridge Pool, Sutton Park! Erdington, in old clay pits! Canal bridge, near Olton Pool! walls near Arley Wood! Fine form on dripping banks, canal near Rowington! Fruiting in Spirng.

148.—*Tortula rigida* Schultz. On walls in lias districts, rare. Wall tops just past church, at Harbury! wall of farm, Green Lanes, near Wilmecote! Fenny Compton! Kineton! Fruit, Winter.

149.—*T. ambigua* B. and S. On walls and banks. Local in North Warwick, more frequent in South Warwick on lias soils. Walls between Nuneaton and Hartshill! near Arley Wood! Astley! Bearley! Harbury! Fenny Compton! Snowford, near bridge! &c. Fruit, Winter.

150.—*T. aloides* Koch. On clay banks and mud-capped walls, local. Clay banks, Bearley! Red Hill, near Alcester! near Stratford-on-Avon! walls near Nuneaton, with last species! Canal bank, near Olton! Marston Green! &c. Winter.

151.—*T. cavifolia* Schpr. *Pottia cavifolia b. gracilis* Wils. Local. Abundant on walls capped with lias mud. Fenny Compton! Harbury! March.

153.—*T. atro-virens* Sm. *Desmatodon nervosus* Br. and Sch., Wils. *Trichostomum convolutum* Brid., Berk. On marly banks in lias soils. On a marly bank on the Alcester Road, three miles from Stratford-on-Avon, December 1875. I only found a single tuft on this occasion, and have not since been able to find more. It is a remarkable moss to find so far inland. Winter.

154.—[*T. cuneifolia* Dicks. On banks in the coal measures. This species I have found near Halesowen, near Birmingham, on the coal measures fairly abundant. It may probably be found in similar soils in Warwickshire. There is no doubt as to the Halesowen plant. It has been submitted to Dr. Braithwaite, and was also pointed out by me to Dr. Fraser and Rev. J. H. Thompson. As this is a maritime species, its occurrence so far inland is remarkable.] Fruit April.

156.—*T. marginata* B. and S. On sandstone walls and the stonework of bridges, local. Sutton Park! Walls of Rowington Hall! Walls of Meriden Park! Sandstone walls, Guy's Cliff! Allesley! Milverton! May, June.

158.—*T. muralis L.* On walls. Very common in all districts I have visited.

Var. b. incana. A very hoary form, more rare than type; growing on the mortar of brick walls, canal bridges, near Bearley! Hatton! Wilmecote! Abundant on wall at Guy's Cliff! March, April.

Var. c. æstiva *Schultz.* On damp sandstone walls. On stone coping near Powell's Pool, Sutton Park! stonework of dam, Bracebridge Pool, Sutton Park!

Var. d. rupestris *Schultz.* On old walls and marly banks, more local than type. Canal bridge, near Shrewley Common! wall of farm near Rose Hall, Alcester! near Grafton, on banks! stone walls near Fillongley!

159.—*T. unguiculata* Dill. Walls, banks, fields, &c., in most soils, very frequent and very variable. Marston Green, &c.!

Var. b. cuspidata *Schultz.* On mortar coping walls near Hartshill! on lias banks near Wixford! December.

160.—*T. fallax* Hedw. Banks in marly and sandy soils, local. Shustoke, on railway bank! Marston Green, on railway bridge! Erdington, in old clay pits! Sutton Park! November.

163.—*T. rigidula* Dicks. Wall tops; more frequently in lias districts. Wall of churchyard, Ufton, near Southam! Harbury! near Henley-in-Arden! November.

164.—*T. spadicea* Mitt. *Trichostomum rigidulum* Wils., Berk. Banks and damp walls, local. Bearley! Red Hill, on lias soil on footways! Ballards Green, by Arley Wood! bridge near Henley-in-Arden! Always barren in these districts.

165.—*T. cylindrica* Tayl. *T. insulana* De Not. *T. vinealis b. flaccida* Wils. On banks, &c., rather local. Near Claverdon, on the way for High Cross! Sutton Park, Bracebridge Pool, and Druids Well!

166.—*T. vinealis* Brid. Banks and walls, rare. Wall of Milverton churchyard!

167.—*T. Hornschuchiana* Schultz. On the mortar and walls and on the ground in marly soils, local. Canal bridge, Shirley Heath! Bearley! lane near Fillongley! Yarningale Common! Ballards Green! Very rarely fruiting. Spring.

168.—*T. revoluta* Schwg. On the mortar of walls, not rare. Near Solihull! Fillongley! Shirley Heath! Bearley! Binton! Sutton Park! Shrewley Common! All in fruit. May.

169.—*T. convoluta* Hedw. On walls and waysides, local. Sutton Park! abundant on heathy places by Whitacre Railway Station! wall of cottage near Meriden Shafts! Railway bank, near Gravelly Hill! May, June.

171.—*T. tortuosa* L. On old walls, very rare. Somewhat sparingly on a canal bridge near Olton! I have not seen it elsewhere in the county, but have noticed it in the above station for ten years.

175.—*T. Brebissoni* Brid. *Tortula mucronata* Brid., Berk., Hobk. *Cinclidotus riparius, b. terrestris* B. and S., Wils. On roots of trees near rivers, rare. Banks of the Avon, near Bidford! in fine fruit on banks of Alne, near Aston Cantlow! on old bridge, near Holywell! near Henley-in-Arden! Fruit May.

176.—*T. subulata* L. On sandy banks, walls, and tree roots occcasionally. Near Oakley Wood! Copt Heath! Harbury! on walls Guy's Cliff! Packwood! Kingswood, Fillongley! May, June.

177.—*T. lævipila* Brid. On trees, sometimes on stone walls, not rare. Copt Heath! Rowington! Ufton! Edge Hills! Harbury! Binton! Oakley! Offchurch and Birdingbury! Milverton! Quarries near Warwick! May, June.

178.—*T. latifolia* B. and S. On roots of trees and woodwork near streams, rare. Wooden bridge and alders by stream near Holywell! on willow trunks, banks of Avon, near Bidford. Bridle road from Chadshunt to Drayton Bassett! Always barren.

179.—*T. ruralis* L. Thatched roofs, walls, &c., rare in North Warwick, frequent in South Warwick. Temple Grafton! near Oakley Wood on trees! wall by Chesterton Windmill! near Hartshill! Maxtoke Shustoke! Coleshill! Spring.

180.—*T. intermedia* Brid. *Tortula ruralis, b. minor* Wils. Wall tops and lias banks. Banks near Temple Grafton! walls Edge Hills Binton! Harborough Magna! Fillongley! Harbury in fruit! May.

181.—*T. papillosa* Wils. On trees and old pales, local. Old pales Olton Canal! foot-bridge near Holywell! on elms near Alcester Lodge! on ash trees Marl Cliff! abundant on elms between Alcester and Stratford! near Birdingbury! Marston Green! Always barren.

185.—*Ceratodon purpureus* L. Heaths, banks, walls, &c., very common in all the districts I have visited. May.

[TO BE CONTINUED.]

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF AUGUST, 1879.

BY W. JEROME HARRISON, F.G.S.

Still another wet unsummerlike month! The frequent and heavy rains were only diversified by severe thunderstorms, and, with a maximum temperature hardly ever rising above 70°, it was difficult to realise that we were in what should be the hottest period of the year. The storms on the 2nd and 16th were very remarkable. The former gives us the maximum rainfall for the East Midland stations, and the latter for the West Midlands; at the Southern stations the 19th was the day of heaviest fall. About the storm of the 16th Mr. Davis, of Orleton, writes, "Another great storm of lightning and thunder set in on the afternoon of the 16th, and continued till after midnight, with great darkness and heavy rain till 8 P.M. on the 17th, producing great floods." The average temperature for the Midlands was 57°. The hay harvest was much interfered with, and along the Soar Valley (Leicestershire) a great quantity of mown hay was washed away by floods; the corn harvest had not commenced at the end of the month.

NATURAL HISTORY NOTES BY OBSERVERS.—*Alstonfield Vicarage.*—Haymaking still unfinished; many fields of grass still uncut. Oats showing little prospect of ripening. Swallow tribe are leaving unusually early; the Swifts left on the 11th, although a pair of these birds were seen flying rapidly to the southward over this house on the evening of the 23rd. The greater portion of the swallows seem to have retired from this part soon after the swifts. A few swallows and some house martins still remain here. The Painted Lady butterfly has been seen several times this season. *Shifnal.*—One Humming Bird Sphinx seen on 5th; several Painted Lady butterflies on and after 14th; a few Tortoiseshell, but not one Peacock. Gooseberry bushes stripped by the caterpillar; slugs and grubs still most destructive. Caterpillars of the Mullein moth *(Cucullia verbasci)* found feeding on *Verbascum virgatum. Spondon.*—*Lilium candidum*, which generally blooms towards end of June, only commenced flowering on August 3. Until the last week of August but few butterflies have been seen; now *Pontia brassicæ* is becoming plentiful. No wasps seen since very early spring. *Stroud.*—List of flowers and date of blossoming: 1st, *Linaria minor;* 4th, *Mentha sativa;* 7th, *Geranium dissectum*, Moneywort, *Potentilla reptans, Teucrium Scorodonia, Convolvulus arvensis, Circæa lutetiana, Sagittaria sagittifolia, Campanula glomerata, Sambucus Ebulus*, Goat's Beard, Bird's Nest, *Hypericum pulchrum, Epilobium angustifolium, Lithospermum officinale, Humulus*

Lupulus, *Tamus communis*, *Erythræa Centaurium*, *Agrimonia Eupatoria*, *Filago Gallica*, *Nymphæa alba;* 14th, Burdock, *Chrysanthemum inodorum*, *Sedum dasyphyllum*; 21st, *Convolvulus sepium*, *Lythrum Salicaria*. *Altarnun.*—The third very wet month in succession. As disastrous as 1860 for hay, corn, and "turf" (peat) harvests. A little corn out in the last week; oats promising well; wheat and barley poor. No turf cut yet, and much hay still on the fields. Trees browning very early, especially sycamores.

STATION.	OBSERVER.	RAINFALL.				TEMPERATURE.			
		Total for M.	Greatest fall in 24 hours.		No. of rainy d.	Greatest ht.		Great'st cold	
		In.	In.	Date.		Deg	Date.	Deg	Date.
GLOUCESTERSHIRE.									
Cheltenham	R. Tyrer, Esq.	6·56	2·32	16	19	77·1	12	41·4	24
Stroud	S. J. Coley, Esq	5·39	1·62	17	18	73·0	13	46·0	30
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	6·16	1·36	17	18	74·0	11 & 12	39·5	19
Whitchurch	A. B. George, Esq	8·48	3·42	17	19				
Woolstaston	Rev. E. D. Carr	6·23	1·65	16	22	72·0	28	43·0	9
Leaton Vicarage	E. V. Pigott, Esq	6·21	1·88	16	20	75·0	12	39·1	10
More Rectory, Bishop's Castle	Rev. A. Male	6·38	1·80	16	22	76·0	12	40·0	24
Larden Hall	Miss F. R. Boughton	5·59	1·53	16	20				
Bishop's Castle	E. Griffiths, Esq.	5·38	1·50	16	20	76·0	12 & 15	41·0	10
Cardington	Rev. Wm. Elliott	6·08	1·76	16	20				
HEREFORDSHIRE.									
Stoke Bliss	Rev. G. E. Alexander	7·04	2·00	16	17	75·0	12	41·0	31
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq	6·21	1·88	16	21	77·7	12	43·3	2
West Malvern	A. H. Hartland, Esq.	6·85	2·02	16	21	80·5	12	49·5	30
Pedmore	E. B. Marten, Esq.	6·55	1·69	16	19	80·0	12	43·0	30
Longlands, Stourbridge	J. Jeffries Esq.	6·65	1·92	16	17	80·0	11	36·0	31
Dennis, Stourbridge	Mr. C. Webb	5·63	1·80	16	18	76·5	12	35·0	31
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	5·31	1·35	17	20				
Dudley	Mr. J. Fisher	6·40	1·59	17	22	80·0	12	40·0	31
Sedgley	Mr. C. Beale	4·98	1·13	17	23	73·0	12	44·0	30 & 31
Kinver	Rev. W. H. Bolton	5·91	1·29	16	18	79·0	11	36·0	31
Walsall	Mr. N. E. Best	5·81	1·38	17	22	73·0	12	42·0	31
Grammar School, Burton	C. U. Tripp, Esq.	5·00	1·50	2	19	79·0	13	40·0	10 & 30
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	6·59	1·74	16	22	76·0	11	43·0	30 & 31
Wrottesley	E. Simpson, Esq.	5·36	1·56	16	17	76·8	13	43·0	31
Heath House, Cheadle	J. C. Philips, Esq	7·25	1·64	17	19	74·0	12	44·0	30 & 31
Alstonfield Vicarage	Rev. W. H. Purchas	7·40	1·06	17	18	72·4	12		
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	5·20	1·17	2	19	76·0	12	42·0	31
Coventry	J. Gulson, Esq.	5·18	1·15	17	20	75·0	11	40·0	31
Bickenhill Vicarage	J. Ward, Esq.	5·59	1·15	17	19	72·0		43·0	
St. Mary's College	Rev. S. J Whitty	5·47	1·46	2	19	75·8	12	44·2	30
Henley-in-Arden	T. H. G. Newton, Esq.	7·98	1·50	16	20	78·0	11 & 12	42·0	24
DERBYSHIRE.									
Stoney Middleton	Rev. U. Smith	5·53	·90	27	18	74·0	12	33·0	1
Fernslope, Belper	J. G. Jackson, Esq.	5·45	1·19	2	20	74·0	12	45·0	8, 10, 30
Linacre Reservoir	C. E. Jones, Esq.	4·23	·68	16	19				
Spondon	J. T. Barber, Esq.	5·46	1·12	3	21	70·1	12	35·0	31
Duffield	W. Bland, Esq.	6·24	1·39	2	18				
NOTTINGHAMSHIRE.									
Hesley Hall	B. J. Whitaker, Esq.	4·22	·80	5	21	77·0	12	43·0	9
Tuxford	J. N. Dufty, Esq.	2·79				70·0	4	41·0	31
Hodsock Priory, Worksop	H. Mellish, Esq.	3·53	·77	2	20	74·9	12	42·1	10
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	3·59	1·02	2	16	78·0	11	42·1	10
Ashby Magna	Rev. E. Willes	4·63	1·25	2	20	77·0	11	42·0	10
Market Harborough	S. W. Cox, Esq.	3·49	·92	2		72·0	15	34·0	31
Kibworth	T Macaulay, Esq.	4·11	·81	2	20				
Town Museum, Leicester	W. J. Harrison, Esq.	4·01	1·18	2	19	75·2	12	43·5	8
Belmont Villas, Leicester	H. Billson, Esq.	3·92							
Syston	J. Hames, jun., Esq.	3·31	·94	2	19	84·0	13	45·0	10
Waltham-le-Wold	E. Ball, Esq.	3·96	1·88	2	16	74·0	11	41·0	8
Little Dalby Hall	G. Jones, Esq.	3·79	1·56	2	21	65·0	12	42·0	10
Coston Rectory, Melton	Rev. A. M. Rendell	3·67	1·30	2	21	72·0	12	37·5	8
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	3·69	·87	19	16				
Castle Ashby	R. G. Scriven, Esq.	3·68	1·01	19	16	75·0	12 & 15	42·0	31
Kettering	J. Wallis, Esq.	2·95	·80	19	13	74·0	13	50·0	10, 30, 31
Althorpe	G. S. Groom, Esq.	3·38	·87	2	15	73·0	11	36·0	31
Pitsford	C. A. Markham, Esq.	4·21	1·00	2	16	80·0	12	42·0	9
RUTLAND.									
West Deyne, Uppingham	Rev. G. H. Mullins	2·87	·82	2	16	77·2	12	43·8	10
Northfields, Stamford	W. Hayes, Esq	3·31	·74	16	15	80·0	15	36·0	10
Ratcliffe Observatory	H. R. Bellamy, Esq.	5·05	1·25	19	17	75·7	12	40·8	31
Ventnor Hospital	W. T. Ryder, Esq.	5·58	1·22	19	10	69·2	10	52·1	30
Altarnun Vicarage	Rev. J. Power, M.A.	6·00	·90	20	23	79·0	12	41·0	30

Correspondence.

Injurious Insects.—The whole of the gooseberry and currant bushes in this neighbourhood are entirely denuded of leaves by the larvæ of a sawfly. They are here in countless thousands. The bushes are dreadful objects, not a vestige of green left on them, but plenty of fruit. Other pests are abundant, but partial; but the gooseberry grubs are everywhere. —V. R. Perkins, Wotton-under-Edge, Gloucestershire, August 8th, 1879. (From the "Entomologist.")

Unsymmetrical Insects.—About five or six years ago, some friends of mine were butterfly catching on Boxley Warren, about 2½ miles from Maidstone, when they netted a specimen of the Common Blue *(Polyommatus alexis.)* The two wings on the one side of the body were of the usual bright blue of the male, while strangely enough the other two wings were brown, edged with red spots, exactly like those of the female. This insect, though sadly battered and in a bad state of preservation, is still in the collection of a friend of mine, of this town. There are, I believe, other instances of similar "unsymmetrical" insects on record.—Fred F. Grensted, Maidstone.

Bee-eater, &c.—In my late communication to you respecting the Bee-eater shot near Derby, I said that there were two shot. Since I wrote the second one has been purchased by a gentleman near Mansfield, and sent to me to be re-stuffed. It is now at my place, and I shall be willing to show it to anyone who may call. It may interest some of your ornithological readers to know that I have in my possession a young specimen of the Shag or Green Cormorant, *(Carbo cristatus,)* shot on the top of a factory in the middle of Nottingham, and also that two other specimens, both young, were caught alive in an adjoining street, and that a fourth was shot about two miles from where the others were got.—L. Lee, Naturalist, 26, Drury Hill, Nottingham.

Leptodora Hyalina.—This interesting and singular Entomostracan, whose capture in this country for the first time was recorded at page 225, has since been found in considerable abundance at Edgbaston Pool, near Birmingham, a fact which leads to the hope that it may be found in other localities. As Leptodora is making some little stir among the savans, and had the honour of being introducéd to the British Association as a "distinguished stranger," it is only fair to say that its first captor was Mr. John Levick, one of the curators of the Birmingham Natural History and Microscopical Society, to whose ingenious devices for obtaining specimens, and keenness in detecting them, the members of the Society and others are indebted for this and many other interesting "finds."—Walter Graham.

Ornithological Notes.—We had several pairs of Wild Ducks breeding here this season. I was told of six nests in one double hedge. They were late, some of the nests having eggs in them the second week in May. The bulk of the Swifts departed on August 12th—two days later than last year. I saw a solitary one on the 22nd, but none since. I have heard several Nightjars this season; usually they are rare. Snipe arrived very early. I saw five on August 8th. Towards the end of that month about a score were seen, and on September 6th I saw over a hundred get up from one reed-covered meadow. Three procured were probably immature birds, being darker coloured than winter-killed specimens. On the same day I saw a Green Sandpiper on the banks of our stream—the Sorebrook. The Snipe were quite as numerous a few days ago. In changing to winter plumage the chin of the Pied Wagtail seems to be affected first. One I shot on the 7th inst. had the back very

little changed, throat spotted with black, and chin quite white. Two observed on the 18th had the back lighter, and throat pure white. Our taxidermist showed me a specimen of the Grey Phalarope, killed on the Cherwell, in this parish, a few years ago. The occurrence of this little Arctic bird so far inland is, I think, noteworthy. It, however, I believe, visits our coasts every autumn on its migration. We have a great dearth of Blackbirds, Song Thrushes, and Robins, especially the last. Before the winter they were very plentiful, but one may now go for weeks and not see a Robin—the frost killed them off.—O. V. Aplin, Bodicote, Oxon, September 19th, 1879.

Remarkable Rainfall.—On the 2nd August there was a remarkable rainfall on the Clent Hills and at Halesowen, being 2·75in. at the latter place. This caused a flood on the Stour remarkable alike for its height and suddenness. It was almost all the red water coloured by the Permian clays of Clent Hills, as the branches of the river coming from the Dudley area were not much swollen. On the 16th the rainfall was more general, and measured nearly three inches over a large area, while near Hartlebury it was more than seven inches, and was thought to be a waterspout. From appearances observed over that district by residents at Wollaston, near Stourbridge, this certainly seems to have been the case, as a very dark black cloud was observed to descend quickly in a funnel-shaped mass to the earth, the lower end waving about in a singular manner. The havoc on the railway near Kidderminster, and the bursting of Stone and Spennels Pools, cutting up a turnpike road with a deep trench across it, showed plainly a most unusual and concentrated rainfall. One garden and orchard, rather hemmed in by a railway and natural embankments, was filled up, the water remaining for days half-way up the lower storey of the house and up to the lower branches of the trees, as there was no outlet for it.—E. B. Marten, Pedmore, near Stourbridge.

Remarkable Egg.—On collecting the eggs from my hen roost on 2nd September last, I found in one of the nests an egg with a perfect shell, but of a very small size, scarcely, if at all, larger than a robin's or house sparrow's egg. The surface was very rough, being dotted over irregularly with projecting lumps of calcareous matter. I tried to blow it with my mouth, in the manner common to school boys, but could not force through the hole a drop of anything, and on rubbing the pin on my finger could find no trace of moisture. I dropped it into a glass of water, when it sank like a stone, without even a bubble of air escaping through the holes. I then cut it open with my knife, and found it filled with a globule of extremely tenacious glairy albumen, without a vestige of yolk. I have the impression that when an ovary is removed from a hen it is usually found to contain a large number of immature eggs, varying in size from a small pea to the full size of the yolk of a perfect egg, and that the substance forming such immature eggs is the yolk. Further that the white of the egg is formed over and around the yolk after it has become detached from the ovary and during its passage through the oviduct, and that finally the shell membrane and shell are deposited over all. Such being the normal order of development, is it not remarkable that a globular lump of albuminous substance, resembling as closely as possible one of the little transparent jelly fish frequently found on the sands at Scarborough, and not surrounding a yolk, should become coated with membrane and shell, and be laid in the usual nest as if it had been a perfect egg? When a hen lays an egg without a shell she usually avoids the nest and drops the egg anywhere, but in this case she was evidently prompted to seek the nest, as though she were going to lay a proper egg. I may say that I have a mixed lot of fowls, but I believe this egg was laid by a white Brahma.—Chas. L. Rothera, Beeston, Notts.

Gleanings.

An Exhibition of Apples and Pears has been arranged for by the Pomona Committee of the Woolhope Club, to be held at Hereford on October 29th and 30th. The Hon. Secs., Messrs. J. R. Symonds and H. C. Moore, will forward schedule of prizes on application to them, at the Free Library, Hereford.

Gilchrist Lectures.—Through the exertions of the Rev. J. Page Hopps, a course of six lectures, in connection with the Gilchrist Trust, will be delivered in the Temperance Hall, Leicester, on Wednesday evenings, commencing October 1st. The lecturers announced are Profs. Martin Duncan and Williamson, Dr. Carpenter, and Mr. Proctor. The charge for admission is one penny to each lecture.

Phosphorescent Sea-weed.—During a recent stay at Barmouth I found on a dark night a mass of sea-weed, recently left by the receding tide, which was most beautifully phosphorescent. On taking up a piece of the weed and rubbing my hand gently along it the phosphorescence became still more luminous, and the luminosity remained for fully half an hour. The smell of phosphorus was also most perceptible. On getting to my lodgings I found the weed covered with Sertulariæ, and I imagine the light-giving *Noctiluca miliaris* had adhered in great numbers to the horny dwellings of the hydrozoa, though I was not able to find it.—E.

Mr. Bolton's Studio.—At the Sheffield meeting of the British Association, Sir J. Lubbock, Bart., M.P., F.R.S., read a paper on the rare and interesting species of Entomostraca, *Leptodora hyalina*, new to this country, which had been recently found near Birmingham. He said he had received the specimens from Mr. Bolton, of Birmingham, and took the opportunity of acknowledging the valuable aid that Mr. Bolton was rendering to microscopic enquiries by sending numerous specimens by post by means of his excellent plan of little tubes, giving great pleasure to his corresdondents, and important aid in spreading the knowledge of many rare and beautiful objects. Professor E. Ray Lankester, F.R.S., speaking upon Sir John Lubbock's paper, said he was very glad to add his testimony to the value and excellence of the work Mr. Bolton was doing in the supply of living microscopic objects. He sent regularly by post to his subscribers, for a very moderate subscription, a numerous supply of living objects in little tubes; and their value and interest were much increased by lithographed descriptions and drawings of the objects that were sent with them. He hoped this excellent plan would receive the support of microscopists generally, to enable Mr. Bolton to keep up so desirable a work. He also remarked that through Mr. Bolton's agency he had seen many interesting objects which otherwise he would not have seen. Mr. Bolton informs us that since his last report (page 213) he has sent out to his subscribers, in addition to the two new Entomostraca figured last month, (Plates IV. and V.,) some marine Infusoria, *Kondylostoma patens; Vaucheria*, one of the fresh-water confervoid Algæ, in an early stage; the interesting clustered Rotifers, *Conochilus volvox* and *Lacinularia socialis;* the Pitcher Rotifer, *Brachionus urceolaris*, and the large Entomostracan *Sida crystallina*—all accompanied by drawings and descriptions. Mr. Bolton has found *Lacinularia socialis* and *Cristatella mucedo* lately in great abundance.

George Henry Lewes Studentship.—This Studentship has been founded, in memory of Mr. George Henry Lewes, for the purpose of enabling the holder for the time being to devote himself wholly to the prosecution of original research in physiology. The Studentship, the value of which is slightly under £200 per annum, paid quarterly in advance, is tenable for three years, during which time the student is required to carry on, under the guidance of a director, physiological investigations to the complete exclusion of all other professional occupations. No person will be elected as a "George Henry Lewes Student" who does not satisfy the trustees and director first as to the promise of success in physiological enquiry, and second as to the need of pecuniary assistance. Otherwise all persons of both sexes are eligible. Applications, together with such information concerning ability and circumstances, as the candidate may think proper, should be sent to the present director, Dr. Michael Foster, New Museums, Cambridge, not later than October 15th, 1879. The appointment will be made and duly advertised as soon as possible after that date.

American Predictions of Coming Storms.—Much curiosity has been excited as to the method by which notices of storms travelling eastward over the Atlantic have been telegraphed from New York to the London office of that enterprising paper, the *New York Herald*. Eminent meteorologists have pointed out that it is long odds against a storm leaving the American coast at any date preserving its character and direction unchanged across the 3,000 miles of ocean which it would have to traverse before reaching this country. But it seems to have been forgotten that swift ocean steamers are continually proceeding from Europe to America, arriving at New York a little before an ordinary cyclone, which they met with say in the mid-Atlantic, could reach England. These steamers are probably boarded immediately on their arrival in America by the agents of the *Herald*, their logs overhauled, any storms through which they passed are examined in connection with those which have left the American shores some days previously, and from the information so gained telegrams are prepared and sent off. There can be no doubt but that if it were possible to maintain some five or six ocean stations—lightships of some kind—at distances of from 100 to 500 miles west of Ireland, and in telegraphic communication with our coast, our Weather Office could accurately foretell every storm approaching us from that direction. Whether it will be possible to fix and maintain such stations is a question for our inventors.

Mr. Marsden's Natural History Agency.—No branch of Natural History has made greater advances within the past few years than that which deals with the relationships of the faunæ of different countries, and the attendant phenomena of variation or similitude. The studies of Ornithology and Entomology specially lend themselves to this branch of enquiry, and as a consequence of the greater attention paid by critical students to this subject there has sprung up a considerable branch of business devoted to the sale or exchange of rare and foreign birds and their eggs; and insects and their larvæ. The advantages of a well-conducted agency of this nature must often have been experienced by those who may have had occasion to work out special groups, or to institute comparisons of allied forms of birds or insects. We have recently had an opportunity of visiting Mr. H. W. Marsden, of Gloucester, who has for many years conducted such an agency with a gradually-increasing amount of success and a proportionately-enlarging sphere of usefulness. We have been much interested in his extensive stock of rare birds, eggs, and insects from all parts of the world, but more especially from those regions which Mr. Sclater has named the *Palæarctic*, embracing Europe and Amurland. Mr. Marsden spares no pains to

secure examples of newly-discovered species. His correspondents include dealers, amateur collectors, and men of science in every part of Europe and America; and a new species, which may turn up in Lapland or in Syria, soon finds its way to his cabinets. It is only by extending such a business to its widest limits that low prices and the highest facilities of exchange are secured. So far as we can judge from an experience of many continental houses, Mr. Marsden offers his *clientèle* exceptional advantages. Our space does not permit of our mentioning other objects which form part of his business, but we can cordially recommend any one interested to pay him a visit.

Reports of Societies.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY. —August 4th, Excursion to Habberley Valley, &c.—August 23rd, Excursion to Maxstoke.—September 10th, seventh Annual Meeting was held in the Council House. There was a large attendance of members. The President (Mr. R. Birbeck) in the chair. The report gave an encouraging account of the present state of the society, the number of members being 134. During the past year fifteen papers have been read, and eight excursions made to places of interest. By subscription and a grant to the committee a first-class binocular microscope had been purchased for the society. The Librarian reported that fifty vols. had been added to the library, and 760 books issued during the year. The report was unanimously adopted, and a vote of thanks passed to the officers and committee for their services during the year. The following elections were then made:—Mr. C. J. Watson, president; Mr. R. Hipkiss, vice-president; Mr. C. R. Robinson, treasurer; Mr. G. Patchet, librarian; Mr. W. H. Cox, hon. sec. At the conclusion of the formal business, the retiring President, Mr. Robert Birbeck, gave a short history of the society from its commencement in 1872 to the present time. The society, he said, had now completed the seventh year of its existence. Its formation was initiated by Mr. C. J. Woodward, and a preliminary meeting was held in October, 1872, attended by about six students in the science classes, and the result was the establishment of a society which had been of inestimable advantage to Institute students, especially where valuable works on science were needed for reference. About 60 papers had been read before the society during the period mentioned, and these had been listened to by large numbers of members. About forty excursions had been organized and successfully carried out, and the library of the society, which at first only mustered about 33 books, has now the very best works on scientific subjects which are in existence, and numbers 393 volumes. In its second year the society organised a movement amongst the students of the Institute for the purpose of augmenting the Institute Building Fund, and the sum realised was £173 13s., and during the year just ended an effort was made by the members, under the guidance and management of the society, to assist the fund being raised for the restoration of the Free Libraries, when the very handsome sum of £205 was collected. In addition to this the Society had just purchased a very excellent microscope for the use of its members. The Society had been prosperous, for its managers had kept steadily in view the prime object of its founders, the assisting by every reasonable means of Institute students, and when the inexpensive character of the society is considered—only 3s. a member per session—it must be a cause for surprise and regret that its numbers—now 140—are not doubled. Why should not the society gather to itself the members of the literature and language classes, and its library become proportionately enhanced in its range, and thus become what some at least wish it to be a truly representative society of the Institute students? May the present committee have this under serious consideration, and see if something cannot be done soon to bring about so desirable a state of things. At the conclusion of the address, a hearty vote of thanks was passed to Mr. Birbeck.—September 17th, the President exhibited a collection of minerals and fossils from Castleton, Derbyshire.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—MICROSCOPICAL GENERAL MEETING.—August 19th. Mr. T. Bolton exhibited an alga, supposed to be a young state of *Enteromorpha intestinalis* which had appeared in one of his aquaria. Mr. J. Levick exhibited *Lacinularia socialis* and *Plumatella repens*, from Barnt Green; Mr. W. H. Wilkinson *Parnassia palustris* and *Pyrola rotundifolia*, from Southport; Mr. J.W. Cotton sent for exhibition a specimen in spirits of *Loligo vulgaris*, the Squid, from Barmouth; Mr. W. Graham exhibited *Argulus foliaceus*, from Spurrier's Pool. GEOLOGICAL SECTION.—August 26th. Mr. W. Southall exhibited a number of plants from the West of England, including *Bartsia viscosa*, *Brassica nigra*, (wild,) *Verbascum virgatum* and *V. nigrum*, *Scirpus maritimus*, *Radiola millegrana*, *Arenaria rubra*, and *Glaux maritima;* Mr. W. B. Grove two of the beautiful caterpillars of the Vapourer moth, *(Orgyia antiqua;)* Mr. W. H. Wilkinson specimens of several species of *Libellula*; Messrs. Caldwell and Butterfield specimens of *Bromus asper*, *Corydalis lutea*, &c.; Mr. C. J. Watson microscopic sections of a boulder from the drift at the Pleck cutting, near Walsall. He also exhibited the printing apparatus called the Scriptograph, (see page 235.) GENERAL MEETING.—September 2nd. Mr. W. B. Grove contributed *Raphidia viridis* from Sutton Park, and an embryo snail, showing pulsation of the heart, and ciliary action on the foot. Mr. H. E. Forrest exhibited a goldfish from the aquarium at the Aston Lower Grounds, having two tails, united together along their upper edges in the shape of an inverted V; Mr. Montagu Browne the femur and part of the tibia of the extinct *Dinornis* of New Zealand; Mr. J. Levick a supposed new species of Rotifer. BIOLOGICAL SECTION.—September 9th. Mr. W. Graham announced that the rare Entomostracan *Leptodora hyalina*, recently found by members of this society at Olton, and not before recognised in England, had been again taken in enormous quantity in Edgbaston Pool, on occasion of the visit of the members, by dipping to a depth of about four feet from the surface. He also exhibited a new form of portable microscope, manufactured by Mr. Parkes, of this town, and possessing the essential points of a good instrument at a very moderate price; also, a compressorium of improved construction, ensuring actual parallelism of the two surfaces. Mr. Bolton contributed *Ophrydium sessile*, *Leptodora hyalina*, *Hyalodaphnia Kahlbergensis*, *Alcyonella fungosa*, *Plumatella repens*, and *Spirogyra Mülleri*, all from Edgbaston Pool.

NOTTINGHAM NATURALISTS' SOCIETY.—September 3rd. A special general meeting was held to consider several subjects of special interest to the society.—September 17th. There was a discussion on the origin, extent, and chemical composition of the Magnesian Limestone. The debate was commenced by the Hon. Sec., who gave a description of the Permian rocks generally, particularly with regard to the character of the red sandstones and marls, of which a great variety were exhibited from the cutting of the Bennely and Bulwell Railway, together with about 100 specimens of fossil teeth from the caves of Cresswell Crags. Votes of thanks were awarded to the Hon. Sec. for his address, and to Mr. Bull for his assistance in procuring the rock specimens.

OSWESTRY AND WELSHPOOL NATURALISTS' FIELD CLUB AND ARCHÆOLOGICAL SOCIETY.—The fourth excursion took place on Thursday, September 4th. The day was fortunately fine. The members and friends met at Whitchurch, and walked first to Pan Castle, a flat-topped mound of some size, and nearly square, with a moat round it. It was probably a fortified place of considerable strength; the country on one side being low and marshy may have formerly been under water, or could possibly be submerged; while on the other side, where the ground is higher, there is a deep ditch cut, at a little distance from the mound, probably used as a hiding place for the defending garrison. From Pan Castle the route lay by Iscoed Park and Wolvesacre Hall, (where there is a portion of an old moat,) and then along the Wiches Brook, which divides Flintshire from Cheshire, past one of the Salt Springs. It is a round pit, two or three yards across, and close to the brook side, into which the overflow runs. The water of the spring is very salt indeed, and the edge is white in places with a thin incrustation of salt. It is not used now. The party then left the Wiches Valley, and proceeded along a Roman road to Malpas, said to have received its name in ancient times

from its bad roads. There they did justice to an excellent tea at the Wyvern Hotel, and then visited the church. It is a handsome Perpendicular structure, much needing restoration, with some very fine and beautifully preserved monuments with recumbent figures in alabaster in each of the chancel aisles. The chief botanical finds were *Parnassia palustris* (Grass of Parnassus) and *Mimulus luteus*, growing in a bog between Whitchurch and Malpas. A resolution of congratulation to the President of the Society, the Bishop of Bedford, on his advancement to the Episcopal dignity, was passed, with deep regret at his retirement from the Presidentship.

WOOLHOPE NATURALISTS' FIELD CLUB.—August 29th. The fourth field meeting of this club was held on the Radnorshire Hills, near Hay. Mr. E. H. Cheese, of Hay, kindly undertook to pioneer the party, and from his local knowledge was enabled to afford much information to the club. After crossing the Wye by the fine iron bridge at Hay, and passing the picturesque village of Clyro, the party arrived at Court Evan Gwyn, where the remains of an old border fortalice were examined. Thence, ascending the steep sides of Clyro Hill, a magnificent view was obtained of the surrounding country. The plain of Herefordshire, bounded by the Malvern and Clee Hills on one side, and the valley of the Wye lying beneath, with its grand background of the Black Mountains and the Brecon Beacons on the other hand, formed a panorama that will not readily be forgotten, and was thoroughly appreciated by the party, one of whom exclaimed, "Call this Italy, and the whole world would come to see it!" A descent was made into the valley where the well-known bog of Rhos Goch lies. After visiting the site of another stronghold of by-gone days the party separated —some going to explore the bog, and the others up a steep hill to Bryngwyn Church. Here, at this quaint old Welsh church, the party were courteously received by the incumbent, the Rev. J. Hughes. The church has been recently restored. There is an interesting old cross in the church-yard, and what appears to be the cover of a stone coffin or tomb let into the wall of the porch; a very old yew is standing near the cross. A gold coin, supposed to be a Burgundian noble of the fourteenth century, was found in the earth of the floor of this church when it was being repaired; the coin belongs to Mr. F. Banks, who had kindly sent it for exhibition; it is in fine preservation, and was an object of great interest to the members. The route afterwards lay along the valley to Painscastle. A halt of a couple of hours was made here, and the site of the old castle was visited. Several very interesting botanical specimens were found at Rhos Goch Bog, including *Triglochin palustre*, *Utricularia vulgaris*, *Lastrea Thelypteris*, and the Royal fern, *Osmunda regalis*. After a delightful drive over the Begwyn Hills, the party arrived at Hay, where they dined at the Crown Hotel. Subsequently, after the ordinary business of the Club had been transacted, Mr. Cheese read an interesting paper on Painscastle. A botanical paper was read by Dr. Holmes, of Leominster, on "The Uses of some Wild Plants."

EXCHANGE.

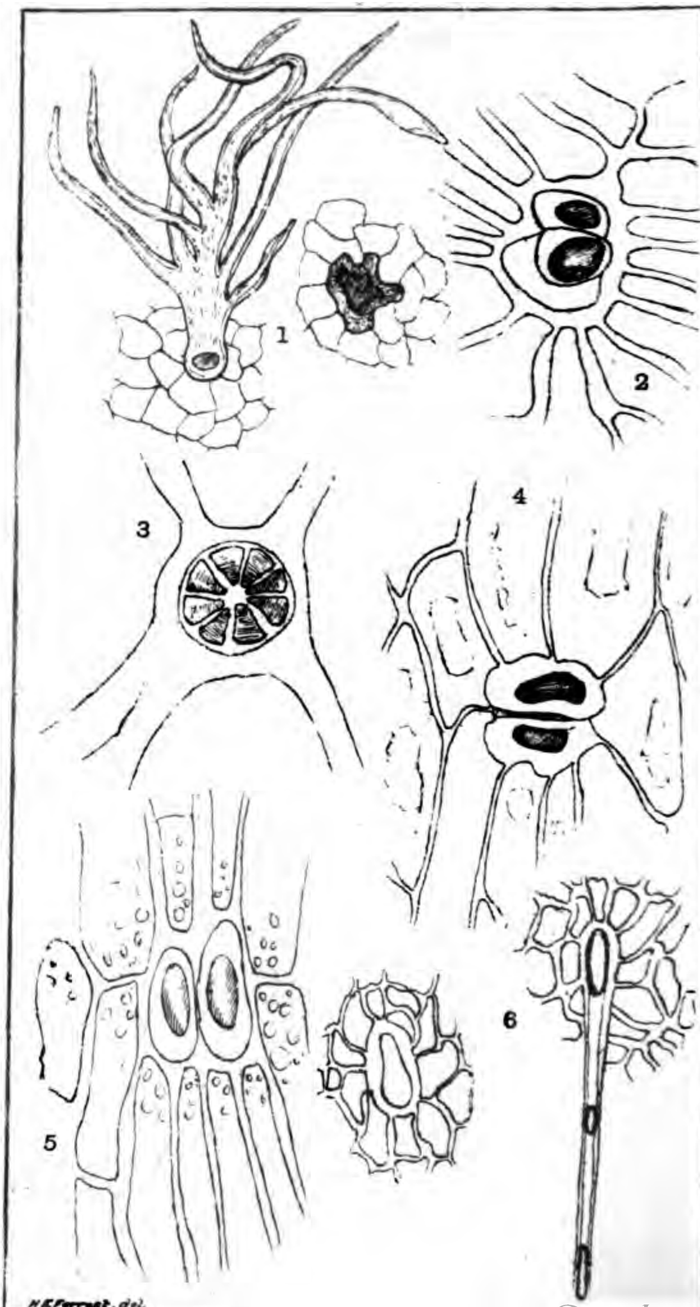
Fine series of Igneous and Metamorphic Rocks of Charnwood Forest offered for good specimens of Rocks or Fossils from any other localities. Junction specimens of the Igneous and Aqueous Rocks, and specimens of Argillaceous Mica-schist with garnets also offered.—F.G.S., 3, Melbourne Road, Leicester.

Books for Exchange.—Twelve vols. "Popular Science Review," five vols. the "Geologist's Magazine." Wanted Insect or Fossil Cabinets, good Lower Lias Fossils, or offers.—F.G.S., 3, Melbourne Road, Leicester.

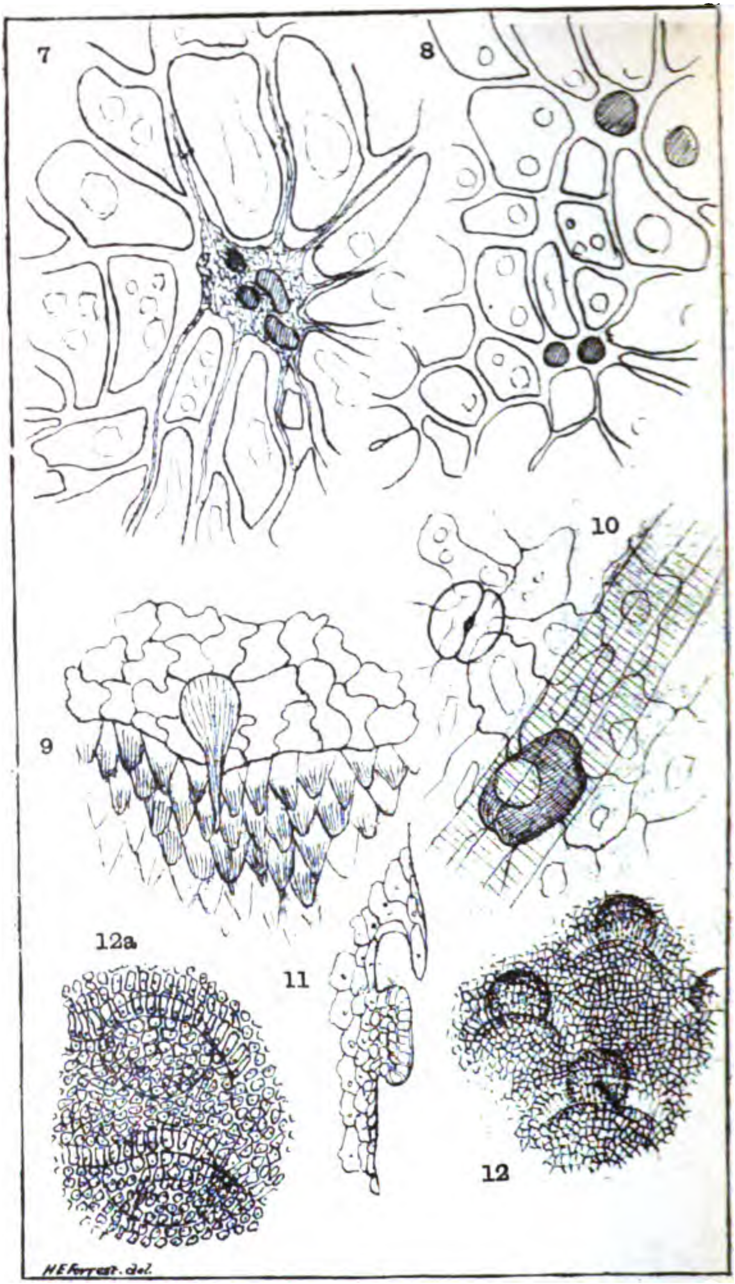
ANSWER TO CORRESPONDENT.

H. F. Devis.—Your plant is one of the sub-species of *Fumaria capreolata*—I think the more rare sub-species, *Fumaria muralis* (Sonder.) It is difficult to decide these plants from dried specimens.—J. E. B.

Plate VII.



Structures of Pitcher Plants, &c.



Structures of Pitcher Plants, &c.

NOTES ON THE STRUCTURES OF PITCHER PLANTS.

BY LAWSON TAIT, F.R.C.S., PROFESSOR OF ANATOMY TO THE BIRMINGHAM ROYAL SOCIETY OF ARTISTS, ETC.

The following notes comprise a series of jottings on the structures of these interesting plants, made whilst I was investigating, at the suggestion of Mr. Darwin, their digestive powers. Some of the observations are, I know, not new, and others I am equally certain will not be admitted without further corroboration. They were made at a time when leisure was more abundant to me than it is now, and I may therefore be excused if I say that I am not likely to travel over the ground again, and shall therefore leave any corrections which may be necessary to be made by future observers.

Mr. Darwin was the first to use the term "quadrifid" to describe certain structures inside the pitcher, which I think he shows are associated with the process of absorption. The term is a very useful one, and I have adopted it, and modifications of it, to describe certain epithelial structures which are of very frequent and constant occurrence in pitcher plants. They consist merely of modified epithelial cells, the walls of which are lined with a thin layer of protoplasm and divided into arms, so that the cell is composed of a set of branching tubes, conducting to one stem, in which is placed the cell nucleus. The number of arms is very various, and therefore I generally speak of these bodies as multifids. They are most numerous, and are most fully developed on the outsides of pitchers covered by the lid from the access of rain, and they are especially large and numerous on those parts of the pitcher where water is most apt to lodge. Thus, in a pitcher of a young plant of *Nepenthes Rafflesiana* they are largest at the point where the stem bends at the base of the pitcher, and in the curvature; the spot where of course water would be longest in evaporating from the surface of the pitcher. Over the general surface of the pitcher they are much smaller, and indeed are mostly to be found only as aborted buds. (Plate VII., Fig. 1.)

In the reversed coriaceous pitchers of an old plant *(N. Rafflesiana)* they are often to be found only as buds slightly raised above the general

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REFERENCES TO PLATE VII.

Fig. 1.—Multifid and bud from *Nepenthes Rafflesiana.*
Fig. 2.—Included gland, *Drosera rotundifolia.*
Fig. 3.— „ „ *Pinguicula alpina.*
Fig. 4.— „ „ *Sarracenia flava.*
Fig. 5.—Ostiole from pedicel of *Drosera* gland.
Fig. 6.—Tubular trichome from fourth zone of young pitcher of *Sarracenia purpurea.*

REFERENCES TO PLATE VIII.

Fig. 7.—Glandulous lacuna infested with fungous growth, *Sarracenia rubra.*
Fig. 8.—Nucleated lacunar expansion from lip of *Darlingtonia.*
Fig. 9.—First and second zones of *Sarracenia purpurea,* showing sudden transition.
Fig. 10.—Nectaries of *Darlingtonia.*
Fig. 11.—Secreting gland of *Nepenthes distillatoria,* in section, showing the hood.
Fig. 12.—Ditto, at upper part of glandular zone.
Fig. 12A.—Ditto, at lower part of glandular zone.

epithelial surface, and not dipping under it. Their contents consist of light brown protoplasm lining the walls, somewhat viscid, and within that a more fluid and slightly darker substance. When a piece of the pitcher on which they are situated is snipped off they rapidly shrivel, and the arms separate. But if a drop of water be placed on the fragment and then gently shaken off it will be found that while it does not adhere to the general surface, some of it has been retained by the arms, which have gathered together, just like the hairs of a brush wetted with water, and in a few minutes they become quite plump.

When this experiment was performed with water containing phosphate of ammonia (after Darwin's plan, but not with such extremely dilute solutions,) the protoplasm was found in some instances, but not in all, to become turbid and to separate into ill-defined masses, and the nucleus went through slow changes in outline. Decaying or digested animal matter did not, in any of my experiments, produce these changes. The distribution of these structures, which will be given more in detail when speaking of individual pitcher plants, and the result of my experiments induce me to believe that they are absorbents of water and such nutrient material as may be dissolved in water without special preparation.

In certain pitchers the multifid buds, instead of appearing wholly above the epithelial surface, are seen to dip partially under it, and this may be seen in favourable instances to advance till the epithelium almost meets over the top of the bud. In this case the protoplasm of the bud may be seen marked by distinct divisions, varying in number from two to nine, the latter being the largest number which I have seen. These divisions of the cell seem to send up processes which appear at the surfaces between the interstices of the epithelium, and such modifications are generally associated with a peculiar system of intercellular canals to be afterwards described. This involution of multifid buds is seen in many surfaces, but it is especially associated with the absorption of decayed or digested animal matter. When the epithelium completely covers these structures I propose to call them included glands, for similar, if not absolutely identical glands, are found in the tissues of many plants, some of which are already known as digesters, (Drosera, Fig. 2, Pinguicula, Fig. 3,) whilst others are not suspected to have such functions.

Dr. John Lindley described these structures in Nepenthes as long ago as 1848, and Mr. A. W. Bennet has also described them in Drosera and Pinguicula under the term *ganglia*, but without entering into any explanation of their function. ("Popular Science Review," Oct., 1875.) In very many cases where they are included they may be seen to occupy lacunar enlargements in the system of intercellular canals, and even where no such canals can be seen they occupy the spaces between the large cells of the parenchyma (as in Pinguicula) in a position where their aid would be almost as effectual. In some cases, as in the lids of some Sarraceniæ (rubra and flava, see Fig. 4) and in the pedicels of Droseraceæ, they have intimate relations with the intercellular canals

without being included by the epithelium, and then I give to them the name of *ostioles*. On the pedicels of the Droseraceæ they are seen to be papillary in some instances. (Fig. 5.) These ostioles never have air bubbles in them as the stomata invariably have, unless they have been removed by maltreatment; and they are smaller than stomata, being ·035mm. in their largest measurement, whilst the latter are almost uniformly ·05. Cells do not radiate from stomata as they do from ostioles. Their relations to other parts, their special distribution, and the fact that I have seen their contents undergo changes when the fragment of leaf has been bathed in a solution of phosphate of ammonia, and once in the case of *Drosera intermedia*, when the leaf was bathed in a solution of peptone, the result of digestion in a Nepenthes pitcher, make me certain that their function is the absorption of the food of the plant.

Another variety of epithelial absorbent is the tubular trichome found in certain pitchers. It is always associated with a system of intercellular canals, and seems really to be developed from the protoplasm contained in these canals more than from a cell, the cell wall apparently going to constitute the lining membrane of the tube, its protoplasm disappearing. At the upper side of the margin of the base of the trichome its protoplasm can be seen to be continuous with that of the intercellular canals; and in the growth of the hairs this can be seen to be deepening in colour and increasing in quantity at the lower part, so as to form the process of the trichome. This observation can be best made at the lower part of the fourth zone of a young pitcher of *S. purpurea* (Fig. 6.) At the free extremity of these tubular trichomes there must be a true stoma, though I cannot pretend to have seen it. But I have seen a bubble of air enter at the extremity of the tubule, and I have traced its slow passage, coincident with the shrivelling of the fragment examined; and the air bubbles may be made to alternate with short columns of water by alternately wetting and drying the surface.

The systems of intercellular canals to which I have referred are best seen on such surfaces as absorb digested food. Thus on the inner surface of a Nephenthes pitcher examination by high powers will demonstrate these canals beyond dispute. They are walled and contain protoplasm, for its columns may be seen broken at irregular spots. They are undoubtedly absorbents, for I have repeatedly satisfied myself that they were larger in pitchers which had been fed, had digested and were absorbing their food, than they were in virgin or starved pitchers of the same plant; and the fact that the tubular trichomes of Sarracenia are developed from the protoplasm contained in these canals is a further argument in favour of this view. The most complete proof of the actual existence of these canals is to be obtained from diseased epithelial surfaces where fungous growth is found to be extending into them from an ostiole and distending them. In several pitchers of *S. flava* and also of *S. rubra*, I have found the ostioles so infected that their characteristic protoplasm had been destroyed, but their canals were so dilated that the connecting systems between the ostioles could easily be traced and

canals could also be seen dipping deeply down into the parenchyma of the lid. The appearances seen strongly reminded me of the effects of a poisoned wound of the finger upon the superficial lymphatics of the forearm. (Plate VIII., Fig. 7.)

In the lip of Darlingtonia I have seen them with nucleated lacunar expansions (Fig. 8) quite identical with similar appearances which I have already described in the human umbilical cord, (Proceedings Roy. Soc., No. 163, 1875.) In many cases, however, they do not possess distinct walls, but seem to be mere tubular interspaces between cells.

The last structure found in pitcher plants to which I shall make special reference is the secreting gland. These are limited to the Cephalotus and Nepenthes. In the former they are buried in a pit excavated in the parenchyma and lined by epithelium. They are constructed of modified epithelium, arranged very much like the elements of the glands of the Drosera and Dionæa as described by Darwin. They are probably also absorbents, their two actions alternating; but of this I have no evidence save the analogy with the glands of Drosera.

[TO BE CONTINUED.]

SCIENTIFIC NAMES.—II. PRONUNCIATION.

BY W. B. GROVE, B.A.

(Continued from Vol. I., p. 152.)

The rules concerning the pronunciation of words come under two heads, (1) as to the sound of single letters, (2) as to the syllable upon which the accent falls. Upon the second head, in the case of Latin, at least, there is very little difference of opinion, but with regard to the first the ideas of many persons are in a transition state. The old-established idea was that each nation should follow the precedent of *its own* language in determining the sound of the various letters in Latin words. But, though this was the theory, the practice, at least among ourselves, was very different, and the accepted model was a combination of diverse styles, together with a little of no style at all.

In the case of scientific nomenclature the confusion is worse confounded on account of the medley of sources from which it is derived. Sometimes when a native name of a plant or animal formed part of the scientific name, or when some discoverer with an appellation full of unclassical consonants and diphthongs was to be immortalised, an attempt was made to diminish the incongruity by Latinising the word on the same principle on which the Romans themselves converted the words which they adopted from other nations, as when they changed Caradoc into Caractacus. But this is seldom done now, and the practice sometimes leaves the original form of the altered name uncertain, and thereby fails after all to immortalise anybody in particular. No apology is now thought needful for placing a word which is pure Greek side by side with one which is pure Javanese, *e.g.*, *Strychnos Tieuté*, a tree which grows in Java. The old principles will no longer suffice, and any change will most likely

be in the direction in which opinion now seems to be tending, viz., that, when we borrow the words of a foreign nation, we must borrow the pronunciation too, however unlike that may be to our own. This is done to some extent already, and if we once adopt the principle we shall have no tenable ground left for refusing to apply it to the classical tongues. I will proceed to indicate the chief points in the "old" pronunciation of Latin. Besides giving a number of the ordinary rules, I have also endeavoured to investigate the truth about some cases in which I believe the common practice or belief to be faulty.

One most important point to be remembered is that *every vowel must be pronounced;* there are no silent vowels—thus, *vulgare* has three syllables, *Cardamine* and *Trichomanes* four each. The final syllables of such words have the sound of the final syllables of the words *duty* and *duties*. It is sometimes indicated in books by accenting the letter, thus *é* or *è* or (less properly) *ë*. Another point is that each of the vowels can be either long or short; this is called its "quantity," and is marked in all the dictionaries, in every case where it is required, by the signs ¯ for long and ˘ for short. The usual sounds of the vowels are given in the following pairs of words:—

Băn, bāne; mĕt, mēte; pĭn, pīne; cŏn, cōne; tŭn, tūne; cy̆st, cȳme.

It is a general rule that one vowel immediately preceding another is short; in this case the quantity need not be marked. Thus Glădiŏlus will be found marked as given; the *i* is short by position, as it is called, before the *o*, and the word if fully marked would appear as Glădĭŏlŭs. From this rule we must except all cases where the vowel preceding represents either of the Greek long vowels *ē* and *ō*, or diphthongs, which are necessarily long. So the *o* in Polyzōa is long, and the *i* in Conium, (Gr. *koneion*, "hemlock,") as also in many other words in *-ium*, which custom, however, seems to permit us to pronounce short.

When it is said that all vowels must be pronounced separately, of course the case of two vowels forming a diphthong is excepted. The chief diphthongs occurring in true Latin words are these five:—æ, œ, (both pronounced like *e* in *mēte*,) au, ei, and eu, (pronounced as in *laud*, *height*, and *Europe;*) in Greek there are the additional ones *αι* and *οι*, represented by the first two of the above five, (with a few exceptions, as in *dioicus* and *Aira*,) and *ου* represented by *u*. (See "Midland Naturalist," Vol. I., p. 152.) Consequently, whenever in words formed from true classical sources we have any two vowels coming together which are not among the above-mentioned five, we may generally conclude that they do not form a diphthong, and must be pronounced separately. For example, Eŏzoŏn, Aïzoŏn, Hypecoüm, bromoïdes, each of which consists of four syllables; aïzoïdes, conoïdeüs, pyrenaïcum, each five; and hiëracioïdes, seven. Sometimes, even the five combinations first mentioned are not diphthongs, *especially when they come at the end of a word*—as Hippophaë, Hierochloë, Isoëtes, Silaüs, Nereïs, Rheüm, Heracleüm, gramineüs, &c. It should be noticed that *u*, standing between *s*, *q*, or *g*, and a vowel, is pronounced like *w* in English; thus *suecicus* begins like *sweet*, and so with Suæda, Quercus, Lingua, &c.

The consonants, in the old style, are pronounced almost exactly as in English, even to the extent of giving *ti*, *si*, and *ci*, in such words as

Spartium, Blasia, and Vicia, the peculiar sounds which occur in the respective English words, nation, occasion, and vicious; this, however, is not always done, and I shall have more to say on this point hereafter, as also on the habit of not pronouncing the initial consonant in such words as Pteris and Psamma. *Ch* is always hard, as in monarch, *e.g.*, Chara, Chelidonium, Colchicum, and *j* must be sounded like *y* in a few words, viz., Leucojum, Thuja, Najas, Epigejos, majalis, &c. The *j* here, in fact, is only a misleading way of writing *i*, as may be proved by the derivation; *e.g.*, *Convallaria majalis* is the lily "of May," *maialis*. These words are sometimes written Leucoïum, Thuya, &c., and it would be better to do so always. It will be seen hereafter that the sound which we are compelled to give to *j* in these cases is that which, in the "new" style, is given to it in every case.

In determining upon which syllable the accent should fall, we are to consider whether the last syllable but one (called the *penult* or *penultimate)* is long or short.

(1) If the penult is long, the accent falls on it, as in Myosu′rus, Sola′num, Eri′ca, Anemo′ne, Œnothe′ra, Trienta′lis, Ibe′ris, Isa′tis, Caki′le, Rese′da, Jasio′ne, Potamoge′ton, Sila′üs, Conochi′lus; this rule must always be strictly observed. Some of the words given above and others (of which *Cotyle′don Umbili′cus* is especially a trap for the unwary) are habitually mispronounced, but though we may and indeed must now say Ane′mone as an English word, we ought to speak of *Anemo′ne nemoro′sa* as a botanical name. It is worth notice that in a passage of one of our poets, the word has its original accent:—

> "Let me the blue-bell'd hyacinth behold,
> The silver anemone of the wood,
> And golden primrose intermingled well."
>
> *Hurdis*, *(1763—1801.)*

But in most cases the persistent tendency of the English people to throw the accent as far back as possible has effected a change:—

> "And then fades silently
> One frail and fair anemone."
>
> *Shelley*, *(1792—1822.)*

(2) When the penult is short, it used to be taught in our schools that the accent must always be placed on the last syllable but two, (called the antepenult,) as in Vi′cia, Cle′mătis, O′xălis, Co′mărum, Hippo′phăë, &c. This arbitrarily assumes that the accent can never fall farther back than the third syllable from the end—a limitation for which no reason can be assigned. It is better, in a certain class of words, to adopt a practice which is now gaining ground, and is embodied in the following rule:—

(3) In such words as Glădĭŏlŭs, place the accent not on the *i*, Gladi′olus, but on the *a*, Gla′diolus, and so in all cases where a short penultimate vowel is immediately preceded by a short vowel, *e.g.* Co′dĭŏlum, Ca′lcĕŏlus, A′rgĭŏlus, He′pĭălus, Rho′dĭŏla, Lu′tĕŏla, gra′vĕŏlens, A′mblўŏdon, Bra′chўŏdus, Cra′nĭădæ, Trigo′nĭădæ. We thereby avoid lengthening a vowel which, from its position before another, is short. But the conventional mode of accenting the *i*, *e*, or *y* is so well established that few have as yet adopted the rational method here advocated.

This is the whole secret of placing the accent correctly, and it is seen that accuracy depends upon our knowing whether the last syllable but one is long or short. Of course if the word has only two syllables there is no choice, as in Rhe′um, Thu′ya; and it only remains to indicate, as far as possible, the cases in which rules can be given for words of more than two syllables.

(1) It has been said that a vowel immediately preceding another is short; a few exceptions have been already mentioned incidentally, as Coni′um, Sila′üs, Aïzo′ŏn, and there is also the large class of generic names ending in *-ea* and *-eum*, as Ostre′a, Prote′a, Centaure′a, Staphyle′a, Heracle′um. A small number of these, which are simply adjectives, are accented on the antepenult, as Aza′lea, Casta′nea, and the same must be done with all other adjectives ending similarly, such as lu′tĕa, purpu′rĕa, crusta′cĕa, the *-ea* in which has quite a different origin; through ignorance of this some persons affect the barbarous pronunciation lute′a, purpure′a, etc.

(2) There are a number of terminations in which the penultimate is generally long:—

-ides, *-ida*, (meaning "like,") as deltoïdes, *i.e.*, delto-īdes, Molluscoïda; compare Petaloïdeæ, Crinoïdea, Nematoïdeum (see "Midland Naturalist," Vol. I., p. 150.) Though in all such words the *o* and *i* should be pronounced separately, in truly naturalised words they form a diphthong of course, as anthropoid, colloid, cycloid, &c.

-ālis, as Trienta′lis; exc. O′xălis, Cory′dălis, Cau′călis.

-chīlus, "a lip," as Conochi′lus, Cetochi′lus.

-īnus, *-ēnus*, *-ānus*, etc., as alpi′nus, Elati′ne, Paludi′na, veluti′num, Lapsa′na, Dicra′num, Ole′nus, Sile′ne; exc. Fra′xĭnus, Ri′cĭnus, Car′pĭnus, Pla′tănus, Ba′lănus, Ra′phănus, Caly′mĕne, Stropho′mĕna, and all those ending in *-crĭnus*, as Penta′crinus.

-īgo, *-āgo*, *-ūgo*, as Verti′go, Planta′go, Asper′ugo.

-ītes, etc., as Phragmi′tes, Limeni′tis, piperi′ta, Ananchy′tes.

-nēma, "a thread," as Trichone′ma, Hyalone′ma.

-ōtus, etc., "an ear," as Stephano′tus, Dio′tis.

-ūrus, "a tail," as Lagu′rus, Podu′ra, Hippu′ris.

There is also the termination *-oda*. When preceded by *p* the *o* is short, as will be seen below; but, in most other cases, it is the same ending as occurs in the Greek word *dendrōdes*, "like a tree," and must be pronounced similarly. Thus the Ostraco′da are the (bivalve) "shell-like" group of the crustacea. So Cesto′da, Nemato′da, Tortrico′des, &c. This ending should be *-odea* in the plural, and some authors write it so, as Ostraco′dea, etc.

(3) The chief terminations in which the penult is generally short are:—

-ĭdes, *-ĭdæ*, *-iădæ*, etc., as Pota′mides, E′quidæ, Cra′niadæ. It will be seen that the first of these—*ĭdes*—may be invariably distinguished from the termination *-ides*, and those related to it, by the absence of the inserted *o*, which occurs in all such words as hypnoïdes, and here it may be noticed that the absence of this *o* is a sufficient reason why the derivation given in all botanical books that I have seen for Ceratidium,

Oïdium, antheridium, pistillidium, gonidium, etc., is incorrect. On referring to any work which professes to give the origin of these words, it will be found somewhat like this:—Gonidium, from *gonos*, seed, and *eidos*, form. But in that case it must be gono-idium, as I have explained *ante* Vol. I., p. 150. The fact is that these words are diminutives, an antheridium meaning strictly "a little anther," oïdium "a little egg," and so on. In the same way the name of a genus of spiders, Theridion, though stated by Staveley to mean "resembling a beast of prey," really means "a little beast of prey," as may easily be seen by comparing it with the actual Greek words *kunidion*, "a little dog," and *thuridion*, "a little door."

-ŏlus, *-ŭlus*, etc., as Sa′molus, Gla′diolus, Py′rola, Mi′mulus, I′nula; exc. Iu′lus. These are generally diminutives, thus Gladiolus means "a little sword."

-ĭcus, *-ăcus*, etc., as Lu′mbricus, Beto′nica, Sta′tice, Doro′nicum, Di′psacus, A′phaca, Tara′xacum; exc. Urti′ca, Myri′ca, Eri′ca, Verbena′ca, Pastina′ca; Hypericum should also be accented on the penult, it is said, but on rather doubtful grounds, and custom renders Hype′ricum preferable.

-stŏma, *-stŏmum*, "a mouth," as Cyclo′stoma, A′stomum.

-gŏnus, etc., "an angle," as Poly′gonum.

-ptĕron, *-ptĕryx*, etc., "a wing," as Di′ptera, Micro′pteryx, Thely′pteris, Proto′pterus.

-pŏda, etc., "a foot," as Cephalo′poda, Cope′poda, Macro′podus.

-ŏdon, *-ŏdus*, "a tooth," as Leo′ntodon, Cera′todon, The′codus.

-trĭchum, etc., "a hair," as Lepto′trichum, Calli′triche.

In addition to these it must be remembered that the inserted *i* or *o* in compound words is short; this, however, only becomes important when the last component consists of only one syllable. There are many words ending in *-pus*, "a foot," which come under this head, and are frequently mispronounced, as Ly′copus, Orni′thopus, Lo′phopus, Ma′cropus, Coro′nopus, Campy′lopus, Cy′stopus.

Sometimes a difficulty is found about placing the accent in "complimentary" names, and here a little latitude is undoubtedly permissible. But perhaps the practice which has the most authority in its favour is that which places the accent generally on the penult, as in Watso′ni, Graha′mi, Rober′ti, Colema′nni, but on the antepenult in all which end in *-eri* or *-ii*, as Fo′rsteri, Bre′weri, Ga′llii, Eichho′rnii. In the latter case the *ii* is pronounced *ĕ-eye*, not *eye-eye*. In complimentary generic names the accent is placed on the syllable preceding the termination, *-a*, *-ea*, or *-ia*, as Liste′ra, Grevi′llea, Hooke′ria. In order to tell how to accent such words as Lastrea, Saussurea, we must first know their origin. If they are formed on the analogy of Ostre′a, Centaure′a, the *e*, which represents a Greek diphthong, must be long; but if the *e* merely represents an unaccented part of the name of some naturalist, to whom the genus is dedicated, as Greville, Saussure, etc., it would necessarily be short, being used instead of the more usual *i* in order to retain the form of the word. Thus Brownia and Brownea would commemorate respectively Brown and Browne, but there would be no ground for making a distinction in the pronunciation.

[TO BE CONTINUED.]

SUBURBAN GARDENING.

BY EDWARD W. BADGER, F.R.H.S.

INTRODUCTORY.

Of all the varied pursuits which have given pleasure to mankind, or filled up leisure hours agreeably, none have been more warmly or deservedly praised than Gardening. No part of John Milton's glorious poem is more generally appreciated than his glowing descriptions of our first parents' delightful occupations as they tended the plants which adorned the Garden of Eden; and this, apart from the literary beauty of the poem, is no doubt to be accounted for by the universality of the delight which mankind has in tilling the soil, and cultivating fruits and flowers. What greater pleasure can be afforded a child than giving it a tiny garden of its own? Many a wearied man of business finds his most cherished recreation in the quietude of his garden. No occupation is more suitable to the later years of life than the gentler pursuits of horticulture; and even when age or infirmity debars from active participation in the work, the results of others' labours are capable of affording the purest of pleasures. Strange as it is, still it is too true that we English people, with all our love for gardens and gardening, are individually but indifferent gardeners.

At the request of some of our readers, I have decided to prepare some papers on Gardening, and, in doing so, shall endeavour to combine practical directions with such references to the principles on which they are based as will I hope assist occupiers of small gardens to make good use of them. I hope it will not be considered out of place for these articles to appear in the "Midland Naturalist." I think I shall be able to show that gardening is a pursuit well adapted for our working naturalists who are fortunate enough to have a plot of ground attached to their houses, and I am quite sure a man will be a better gardener for being a naturalist too. I hope to be able to prove that "rule of thumb" gardening processes are less educative, less pleasant, and less profitable, than those which are based on a knowledge of the "why" and "wherefore" of what is done or needs doing.

Suburban gardening is always more difficult than gardening in spots where the air is uncontaminated by smoke and impure exhalations, such as prevail in and about populous places. Small gardens surrounded by high walls, where sun and air penetrate but feebly, demand much skill for their successful management, for they are necessarily heavily burdened with disadvantages as compared with plots of the same size fully open to light and air. Then, as a rule, the smaller the plot the more it gets crowded, so eager is the anxious occupier "to make the best" of his limited area; this adds another difficulty, and, in the outset, I would desire to point out that the bulk of garden plants, whether such as are grown for their flowers, or such as are grown for food, are almost invariably allowed too little room for their complete development.

Dwellers near our manufacturing towns whose success in business enables them to live away from their places of business, surrounded by plots of ground capable of unlimited adornment, are as a body aspirants after successful gardening. But their failures, even when cost is no consideration, are far more frequent than their successes. Money is often lavished in vain, because of the lack of needful guidance. The ordinary villa garden is almost always at the mercy of the ignorant jobbing gardener, whose sole purpose in life seems to be to make his employer spend money in vain. He is always striving after the (to him) impossible, for he knows nothing, or next to nothing, of what he pretends to have mastered; and a glorious pursuit, capable at once of being a refreshment and delight, is often, from "lack of knowledge," barren and resultless, except in disappointments.

No one unfamiliar with the routine mismanagement of villa gardens can have the least idea of the waste of resources every day going on in all parts of the country. It seems the lot of those who have such gardens, and who, themselves knowing nothing of gardening operations, rely for the culture of their precious plots on totally unqualified men, to labour and spend money in vain. The sums spent unproductively in this way are enormous. The most feasible remedy for this state of things would be for our suburban residents to strive after a personal knowledge of the principles of successful gardening. This is the plan which will soonest yield satisfactory results. It each for himself will only master the details of successful practice they will as a body very soon find their own reward, and the ignorant persons they employ to "do their gardens" will no longer be able to trade on their employers' want of knowledge, but must be content to "do as they are told."

AUTUMN CULTIVATION.

The year of gardening operations commences as soon as the summer crops are gathered and the ground is unoccupied. It is a great mistake to leave the remains of crops to "cumber the ground." They should be cleared off as soon as possible, and either placed on the rubbish heap to decay, or, which is preferable, particularly where the garden is small and the house near at hand, they should be partially charred, and the ashes added to the compost heap. There is another method of dealing with them, and that is to bury them deeply in trenches. In one way or other they should be got rid of as soon as possible for the sake of health, tidiness, and economy. The exact time for doing this will vary as the summer is prolonged or short; but at the earliest time when crops no longer remain to be gathered the ground should be prepared for those which are to ollow.

The work of preparation may be divided into two parts: (1) cultivation whereby the surface soil and that immediately below it are loosened and their positions altered, the whole being afterwards thrown up in rough ridges so as to expose the largest amount of surface to atmospheric influences; and (2) the addition of fertilisers, usually in the form of stable or mixed farm-yard manure; or in some other way replacing what crops have withdrawn from the soil.

In many gardens, the usual plan is merely to dig the ground one spade's depth. This, though generally done, is far less effective than trenching, which almost always is a more satisfactory method. Some portion, at least, of every garden should be trenched annually. The reasons for doing this are many. In the operation of trenching, the surface soil, which is more or less exhausted, and usually stored with oxygen, gets placed lower down, and undergoes a period of rest, at the same time that it will slowly part with its store of oxygen; the lower soil is brought to the surface, and being invariably enriched with a reserve of fertilising substances, these are rendered available for the support of a crop. By exposing soil to atmospheric influences it is acted upon in a variety of ways. It is sweetened, the particles of which it consists are separated, and so acted upon by oxidation and other processes that some portions which hitherto have lain dormant are rendered fit for ready absorption by the roots of plants, and their growth and development are thereby materially assisted. The mechanical effect of trenching is also of great value, for water is admitted more freely, and when the ground is properly drained, by nature or artificially, as every well-ordered garden should be, whereever the water passes through there air will follow, and the importance of this to the development of healthy and productive crops cannot be overestimated. Then again, crops grown on deeply-stirred soil are able to withstand the vicissitudes of our varying summers far more easily than on soils stirred only to a shallower depth; in rainy ones the roots are less injured by wet, and in dry ones they are least affected by a protracted drought.

There are various methods whereby land may be prepared for succeeding crops, but those known as trenching and bastard trenching are the only ones which the amateur need be familiar with.

TRENCHING.

For deep soils, trenching is the best method. Trenching is a term used to describe the digging of ground twenty to thirty inches deep. It is performed as under :—From one end of the plot to be dug take out a trench two feet wide and two spades deep, wheeling the soil to the other end of the plot. Next loosen the bottom of the trench with a fork in order to assist in deepening the soil available for the roots to ramify through. Mark off the ground into widths of two feet. Then commencing at the width nearest the already opened trench, fill into it the surface soil or "top spits" of the two feet space next to it; then throw the bottom spits of trench No. 2 over the top spits placed at the bottom of trench No. 1, in such a way that when finished a ridge like this Λ shall be left. Having loosened the bottom of trench No. 2 with the fork, fill it up with soil from No. 3 in the same way as No. 1, and so proceed until the plot is finished. Manure should be dug in during this operation in greater or less quantities according as the ground is poor or rich.

BASTARD TRENCHING.

When the soil is shallow—that is, when not more than a single spade's depth is of good quality—a method called bastard trenching

should be used. The plan is this:—Mark off the plot into two feet widths. Dig out the first of these one spade's depth, and wheel the soil to the other end. Loosen the bottom of trench No. 1 as deep as possible with a fork, and mix with the soil a sufficient quantity of manure and vegetable refuse, and throw on this the surface soil from the next two feet space, mixing manure as may be needed. Leave the surface in a ridge and as rough as possible. Treat No. 2 in the same way, and each of the other two feet widths in succession.

Ground prepared in either of these ways in the autumn will be in admirable condition for seed sowing next spring. If the ground is too sandy or too clayey, the occasion of the annual trenching may be taken advantage of to make such additions to it as may alter its texture. In the former case marl should be added; in the latter lime or sandy soil, though, if manure be applied at the autumn digging, the application of lime had better, in most cases, be deferred till spring, some little time before seed sowing. Whenever land is dressed with lime, particularly for the purpose of altering its texture, it should be dug in at once, so that the atmosphere may not rob it of its energy.

MANURES.

Every crop, especially every heavy crop, withdraws from the ground fertilising elements. However rich soil is naturally, its stores are yearly diminished if it is persistently cropped, and if materials replacing what has been withdrawn are withheld. The constant replacement of what is withdrawn, in some form or other, is therefore necessary to maintain the crop-producing powers of a garden. If a nice adjustment of supplies to withdrawals be always maintained, the normal capacity of production will, of course, be preserved. It must be obvious to all who think about the subject that the ordinary methods of manuring are more or less haphazard, but experience has proved that manure consisting of the products of the stable, cow-house, and piggery, in sufficient quantity, is all-sufficing for most garden crops. In our gardens we grow peas, beans, cabbages, and other vegetables, and each takes away from the land *something*. The skilful cultivator tries to ascertain what this something is, and to replace it at the first opportunity. If the crops grown in a given space were allowed to decay there the soil would receive back all that had been taken from it with something added; but our garden crops are more profitably consumed as food, and the withdrawn substances replaced in another form at once convenient and effectual.

The Rev. Henry Moule, vicar of Fordington, impressed by a sense of the importance of maintaining the fertility of land at the least possible cost, as well as by other considerations, has for years advocated the return of human excreta, mixed with dry earth, as the most effectual and least expensive method, at the same time that it afforded a solution of one of the most pressing problems of the time. Where his plan can be properly carried out, no one, we think, can question its value. In the country it can often be carried out easily and economically; but at present, for want of perfect self-acting apparatus, and the difficulty of

obtaining a sufficient supply of dry earth at nominal cost and trouble, we fear the difficulties are too great to prevent its general adoption where its value would be greatest—in our large towns and their suburbs. Wherever the nightsoil can be systematically mixed with *dry* earth, easily moved, stored under a shed, and frequently turned over for a few months before being applied to the land, Mr. Moule's system can be employed with great advantage, and what too often proves a fearful nuisance may be disposed of and utilised as a valuable enricher of the land.

Farm-yard manure, where obtainable, when well mixed and saturated with the drainage from cow-sheds and stables, is one of the best forms in which to apply food to the soil for the production of most of our garden crops. Garden refuse, pea and bean haulm, the remains of all crops, in a state of partial decomposition, may be dug into the ground with advantage. Clippings of hedges, prunings of trees, &c., partially charred, should also be employed as fertilisers. There is scarcely an article of any kind made of organic matter which is not available to swell and add valuable substances to the compost heap.

Artificial manures suitable for the various sorts and conditions of land, replacing what has been withdrawn by the last crop, or supplying what will be required by the next, are readily obtainable anywhere. The requirements of the cultivator and the condition of the land must of course settle what kind of artificial manure can be used most judiciously.

Speaking generally, the best time to apply manure of a permanent kind is when the ground is being prepared in the autumn. By being well incorporated with the soil it will be slowly acted upon by it, and will impart some of its more soluble parts to the soil in immediate contact with it, which will then be in the fittest condition to afford supplies of food to the roots of plants in the spring, when it is most needed, that is, when active growth commences.

On light sandy soils an application of marl, rich in carbonate of lime, &c., is more than equivalent to an ordinary manuring, for it is much more durable in its effects, and supplies ingredients of great value to plants in which the soil is naturally deficient. If marl be easily obtainable enough may be added, with advantage, to so change the texture of a light soil as to incline it towards stiffness. It must, however, be remembered that marls differ very much in quality. In some samples only five or six per cent. of carbonate of lime is present; others contain as much as eighty per cent. Marls also differ as to the proportions they contain of phosphate of lime and potash, and the quantity and composition of the silicates. A rough and ready method for ascertaining whether lime is present is to place a small piece of marl in some good vinegar; if active effervescence ensues, the presence of lime is indicated. If effervescence does not take place lime is absent, or present in too small quantity for the marl to be worth applying.

Where garden ground approaches in character to clay great benefit will be secured by burning a quantity of it annually, and afterwards applying it as a manure. Burning clay causes the particles to lose their adhesiveness, and if this burnt earth be added to a stiff soil in sufficient

quantity it will give a new character to it by rendering it more permeable by water and air, and the roots of plants will be found to ramify through it more easily. Hedge clippings, &c., may be utilised to burn heaps of clay soil, and will contribute to the enrichment of the heaps. Sir Oswald Mosley made a number of experiments with burnt clay, and found its value very great indeed. I quote the following remarks from his pen. He says:—"My gardener sowed two beds of onion seeds. The beds were each eighteen yards by twelve; one was manured with good stable dung, the other with a mixture of burnt clay and vegetable ashes. The produce of the first did not exceed five bushels of an inferior size. The latter was twenty bushels of onions as large as those imported from Portugal. The latter also kept best. An application of the same burnt mixture has been applied with equal success in my fruit garden. I am so fully persuaded of the excellence of this kind of manure that I intend to adopt it generally on my farm." The burning of soils appears to increase the amount of soluble potash in them. In an experiment made by Dr. Voelcker, he found that unburnt clay contained 0·269 per cent. of this ingredient, whilst after burning it contained 0·941 per cent. of potash soluble in acidulated water. Soda, too, when present in soils, has its soluble parts increased by burning. On the other hand the proportion of soluble phosphoric acid and of ammonia are diminished by the process, which is rather against it. But then it must be remembered that burnt earth acquires a greater aptitude for absorbing ammonia from the atmosphere. On the whole, the use of burnt clay is strongly to be recommended. In burning clay care must be taken not to employ too much heat. The clay must never be so far baked as to be coverted into a brick-like substance, but only so much that the lumps of burned clay will readily crumble with a little pressure.

[TO BE CONTINUED.]

THE CRYPTOGAMIC FLORA OF WARWICKSHIRE.

BY JAMES E. BAGNALL.

(Continued from page 256.)

CALYMPERACEÆ.

189.—[*Encalypta vulgaris* Hedw. Banks. This species I have found on sandy banks near the Lickey Hills, in Worcestershire. It may probably be found on similar habitats in Warwickshire.]

192.—*E. streptocarpa* Schwg. On the mortar of old walls, rare. On a small bridge at Earlswood, near Reservoir! on stone walls near New Fillongley Hall! Always barren.

GRIMMIACEÆ.

194.—*Grimmia apocarpa* L. *Schistidium apocarpum* B. and S., Wils., Berk. On walls, frequent. Olton Canal bridge! Elmdon! Binton! Coleshill! Shrewley Common! Pinley!

Var. b. gracilis *N. and H.* On stone walls near Fillongley!

Var. c. rivularis *N. and H.* On stones in stream. Out of large pool at Arbury! Spring.

197.—*G. crinita* Brid. On the mortar of old walls, very rare. On an old bridge near Hatton! This interesting moss was new to our

British flora when found by myself in June, 1872. It was then fairly abundant; unfortunately the next year the bridge was partly pulled down for repairs, and nearly the whole of this moss was thereby exterminated. I was pleased to notice in 1876 that it had begun to make headway again. I believe this is at present the only British station. It is ably described by Dr. Braithwaite, in "Journal of Botany," July, 1872. July.

199.—*G. pulvinata* Dill. Wall tops, very common in all the districts. Spring.

206.—*G. trichophylla* Grev. Wall tops, rare. Wall of Lapworth Churchyard! on Radford Canal bridge, near Leamington! Not found in fruit.

221.—[*Racomitrium aciculare* L. Stone walls. This species I find abundantly on walls of new red sandstone near Halesowen. It may probably be found on like habitats in this county.]

224.—*R. heterostichum* Hedw. Stone walls, rare. Pinley, near Coventry (T. Kirk)! This I also find near Halesowen. Spring.

225.—[*R. fasciculare* and *R. lanuginosum* I also find on stone walls near Halesowen. Probably both may also be found in Warwickshire.]

228.—*R. canescens* Hedw. *Trichostomum canescens* Purt. "Shores of Coleshill Pool" (Bree) (Purt., Vol. III., p. 85.) Heathy waysides, local. Near Berkswell Railway Station on main road to Kenilworth! near Four Ashes Lane leading to Monkspath! Lane from Solihull to Sharman's Cross! Always barren.

230.—*Ptychomitrium polyphyllum* Dicks. Stone walls, rare. Near Binley, Coventry (T. Kirk)! [Abundant on stone walls near Halesowen.] Fruit March.

233.—*Zygodon viridissimus* Dicks. On roots of trees, local in northern part of the county. Copt Heath! near Oakley Wood! between Stratford and Redhill! Lane to Harbury Railway Station, abundant! Bridle road from Drayton Bassett to Chadshunt! Frequent between Offchurch and Long Itchington! Bishops Tachbrook! Barren.

241.—*Ulota crispa* Hedw. *Orthotrichum crispum* Hedw., Wils., Hobk. On trees, rare. "Allesley, Bree," (Purt.) Coppice in Whew-porridge Lane, near Solihull! Shelly Coppice! June.

242.—*U. intermedia* Schpr. On trees, rare. Chalcot Wood, near Umberslade!

247.—*Orthotrichum saxatile* Brid. *O. anomalum* Hedw., Wils., Berk. Local, on stone walls. Bridge near Henley! near Wilmecote! near Holywell! Binton! Harbury! Kineton, Edge Hills! Spring.

252.—*O. obtusifolium* Schrad. On ash trees, very rare. Abundant on a small ash tree near Binton, 1876-78! I have carefully examined every other tree in this district that I could have access to without being able to find this moss again.

253.—*O. affine* Schrad. On trees, &c., frequent, more especially in South Warwickshire. Olton! Copt Heath! Rowington! Chesterton Wood! Wolstone Heath! Edge Hills! &c. June.

260.—*O. tenellum* Bruch. On trees, rare. Between Stratford and Red Hill! near Offchurch! June.

[O. stramineum *Hornsch.* Is very likely to be found on trees in the lias districts; at present I have not found it.]

262.—*O. diaphanum* Schrad. On trees, walls, and stones, frequent. Castle Bromwich! Alcester! Morton Morrell! Wolstone Heath! Sherbourn! Hampton Lucy! &c. May, June.

264.—*O. Lyelii* H. and T. On trees, ash, and elm, local. Near Solihull! Chadshunt! Copt Heath! Wormleighton! Ladbrook! Offchurch! &c. Never noticed in fruit.

265.—*O. leiocarpum* B. and S. On Ontario poplars, rare. Near Rowington Village! May.

267.—*O. rivulare* Turn. "On stones and a water wheel at Bidford Grange —Bree." (Purt., Vol. III., p. 388.)

FUNARIACEÆ.

279.—*Ephemerum serratum* Schreb. *Phascum serratum* Wils., Hobk. In fallow fields, local or overlooked. Sutton Park! Acocks Green! near Solihull! Olton! wood near Maxtoke! Coleshill Heath! March, April.

283.—*Physcomitrella patens* Hedw. Damp marly places. Damp marly bank near Fillongley Hall! Autumn.

285.—*Physcomitrium pyriforme* L. *Gymnostomum pyriforme* Purt. "Bank bounding mill pool at Oversley," (Purt.) On moist banks, &c., local. Sutton Park! Aston! Water Orton! Dukesbridge! April.

288.—*Funaria fascicularis* Dicks. *Physcomitrium fasciculare* Wils., Hobk. *Entosthodon fascicularis* Berk. Heathy waysides and fallow fields, rare. Coleshill Heath! fields near Maxtoke Priory! in a field near Ufton Church, 1872! Sutton Park! April.

290.—*F. hygrometrica* L. Walls, heathy waysides, &c., very frequent. Occurring in all the districts. May, November.

BARTRAMIACEÆ.

292.—*Amblyodon dealbatus* Dicks. On damp turfy heaths, near pools, very rare. Sutton Park! April.

299.—*Bartramia pomiformis* L. On dry shady banks, local. "Lane from Spernall Ash to Middletown" (Purt.) Sutton Park! Middleton Heath! Curdworth! Marston Green! April.

307.—*Philonotis fontana* L. *Bartramia fontana* L., Purt., Wils., Berk. Marshes, rare in fruit. "Cookhill," (Purt.) Near Windley, Keepers', and Bracebridge Pools, Sutton Park! waysides near Four Ashes! April.

[TO BE CONTINUED.]

A TUBE-DWELLING STENTOR.

BY J. LEVICK.

I have been much puzzled for some time past by a curious tube-dwelling Infusorian, which I have found occasionally upon the weeds brought from Barnt Green, (a locality to which we are indebted for so many interesting and beautiful forms of fresh-water life,) and until recently have been quite unable to make out what the creature could be, the specimens being so small and deeply embedded in foreign matter that only a glimpse of the tube and ciliated disc could be obtained.

I had nearly come to the conclusion that my new find was one of the species of *Freia*, possibly *F. elegans*, to which it appeared to bear great resemblance, notwithstanding the difficulty that that genus of Infusoria is described as marine only.

After frequent search, however, I was rewarded by finding a much larger specimen, having an extreme length of about 1-22 of an inch, and I now find it to be a Stentor, with the ciliated disc most curiously shaped, its general outline being not unlike that of the human ear, especially as seen in one position.

The disc instead of being nearly round and at right angles to the body, as in *S. Mülleri* or *S. polymorphus*, stands upright with a frontal lip-like continuation in opposition, forming a cavity which might make a suitable seat for a *Trachelius ovum* or other similarly shaped Infusorian, and looks under the microscope like the old-fashioned bonnet, known as the coal-scuttle pattern.

The body is trumpet-shaped and without cilia, the whole surface being furnished with long contractile hairs or bristles, like the rays of an Actinophrys, which are ranged at equal distances, and, as it turns about in its tube, give it quite a *chevaux de frise*-like character.

The disc has, besides a row of these setæ round its margin, a fine wreath of cilia, and behind a funnel-shaped mouth, also ciliated to its termination, is seen a large contractile vesicle, a moniliform nucleus being, in my specimen, just traceable.

Its colour is dirty white, and it dwells in a roughly constructed tube, formed by a sticky secretion, and, the particles of rejected matter, which are continuously falling upon its disc, diatoms, fragments of algæ, and anything else coming in its way being utilised for the purpose of building up its tube, it has the ragged appearance often seen in the cases of some of the caddis worms.

These particles are precipitated by the action of the cilia, and trickle down its side, making their way through the setæ so closely to its surface as to appear almost as though enclosed within the animal, the tube being perceptibly augmented even whilst under observation, and certainly giving the idea that it is under the control of the creature, whether they are thus guided to its base or driven off, a point I have felt pretty sure about in other Stentors, which, I believe, accomplish this by reversing the action of the cilia on the body, at one time working them upwards, and at another downwards.

It is not social in its habits, as Ehrenberg styles its congeners, which often form a white gelatinous mass, and live in groups, but is isolated, and most easily distinguished from other Stentors. I have not yet recognised it in its free state, and, judging from the smallness of the specimens found, it would appear to form the tube at the beginning of its career.

Turning to the Transactions of the Royal Microscopical Society for April, 1870, I find a new tube-dwelling Stentor described and figured by Dr. Charles A. Barrett, under the provisional name of *Stentor Barrettii*, which, I have no doubt, is identical with mine, though his has a well-formed smooth tube.

This is the second, if not the third, addition to the ever charming family of Stentors, for which we are indebted to the before-named locality—Barnt Green.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF SEPTEMBER, 1879.

BY W. JEROME HARRISON, F.G.S.

STATION.	OBSERVER.	RAINFALL. Total for M. In.	Greatest fall in 24 hours. In.	Greatest fall in 24 hours. Date.	No. of rainy d.	TEMPERATURE. Greatest ht. Deg	Greatest ht. Date.	Great'st cold Deg	Great'st cold Date.
GLOUCESTERSHIRE.									
Cheltenham	R. Tyrer, Esq.	3·26	·72	7	16	66·7	3	35·6	1
Stroud	S. J. Coley, Esq.	2·82	·62	24	16	67·0	3	39·0	1 & 25
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	2·69	·60	24	17	67·0	6	33·0	30
Woolstaston	Rev. E. D. Carr	3·93	1·06	7	20	67·5	3 & 6	37·5	25
Leaton Vicarage	Rev. E. V. Pigott	2·87	·69	7	17	69·0	3	33·0	30
More Rectory, Bishop's Castle	Rev. A. Male	3·31	·93	7	22	72·0	6	30·0	30
Larden Hall	Miss F. R. Boughton	3·08	·67	7	19				
Bishop's Castle	E. Griffiths, Esq.	3·25			16	71·0		35·0	30
Cardington	Rev. Wm. Elliott	3·69	·94	7	17				
HEREFORDSHIRE.									
Stoke Bliss	Rev. G. E. Alexander	4·23	1·56	30	17	66·0	3	46·0	7 & 9
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq	3·25	·44	13	18	77·3	6	33·0	30
West Malvern	A. H. Hartland, Esq.	3·14	·67	23	15	71·0	3	37·0	24
Pedmore	E. B. Marten, Esq.	3·60	·59	28	18	67·0	4 & 17	37·0	24
Longlands, Stourbridge	J. Jeffries Esq.	3·63	·56	24 & 28	17	70·0	2, 6, 7	34·0	24 & 29
Dennis, Stourbridge	Mr. C. Webb	3·45	·73	24	14	72·0	3	36·0	24
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	2·8[illegible]	·59	28	19				
Dudley	Mr. J. Fisher	3·17	·52	24	20	78·0	28	34·0	24
Sedgley	Mr. C. Beale	3·03	·58	28	19	65·0	3	33·0	24
Kinver	Rev. W. H. Bolton	3·09	·5[illegible]	28	20	67·0	6 & 7	33·[illegible]	29
Walsall	Mr. N. E. Best	3·27	·52	24	20	65·0	3	38·0	24
Grammar School, Burton	C. U. Tripp, Esq.	2·90	·60	28	17	74·0	4	35·0	30
Weston-under-Lyzlard R'tory	Hon. and Rev. J. Bridgeman	2·77	·53	24	18	70·0	3 & 6	33·0	30
Wrottesley	E. Simpson, Esq.	2·81	·58	23	16	68·2	4	37·4	[illegible]0
Heath House, Cheadle	J. C. Phillips, Esq.	2·71	·48	28	13	68·0	3	33·0	30
Alstonfield Vicarage	Rev. W. H. Purchas	3·71	·61	8	14	67·8	3	31·5	30
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	3·14	·56	28	15	66·0	2 & 7	42·0	24
Coventry	J. Gulson, Esq.	3·32	·62	23	18	68·0	7 & 8	33·[illegible]	1 & 30
Bickenhill Vicarage	J. Ward, Esq.	3·39	·59	2[illegible]	14	68·0		37·0	
St. Mary's College	Rev. S. J. Whitty	3·15	·54	28	18	71·0	3	36·6	30
Henley-in-Arden	T. H. C. Newton, Esq.	3·27	·60	23	13	70·0	3	36·0	1
Rugby School	Rev. T. N. Hutchinson	2·96	·62	23	16	69·8	3	37·2	30
DERBYSHIRE.									
Stoney Middleton	Rev. U. Smith	2·90	·57	8	12	67·0	4	29·0	29
Fernslope, Belper	J. G. Jackson, Esq.	3·21	·60	28	15	67·0	7	34·0	30
Linacre Reservoir	C. E. Jones, Esq.	2·39	·36	8	15				
Snondon	J. T. Barber, Esq.	3·11	·58	28	16	65·0		30·0	1
Duffield	W. Bland, Esq.	2·88	·44	13	15				
NOTTINGHAMSHIRE.									
Hesley Hall	B. J. Whitaker, Esq.	1·64	·41	14	10	71·0	4	30·0	30
Hodsock Priory, Worksop	H. Mellish, Esq.	2·06	·41	13	15	71·0	3	30·8	30
Park Hill, Nottingham	H. F. Johnson, Esq.	3·39	·92	24	15	67·5	7	39·0	26
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	3·39	·68	24	15	70·9	3	32·7	30
Ashby Magna	Rev. E. Willes	3·41	·69	23	17	70·0	6	33·[illegible]	30
Market Harborough	S. W. Cox, Esq.	2·87	·80	23		64·0	1 & 15	31·0	30
Kibworth	T. Macaulay, Esq.	3·14	·61	23	19				
Town Museum, Leicester	W. J. Harrison, Esq.	3·33	·68	14	15	69·1	3	35·2	30
Belmont Villas, Leicester	H. Billson, Esq.	3·29	·65	13	16	69·0	3	34·8	30
Syston	J. Hames, jun., Esq.	3·12	·59	13	16	72·0	4	35·0	30
Waltham-le-Wold	E. Ball, Esq.	3·47	·60	24	14	68·0	7	36·0	24
Little Dalby Hall	G. Jones, Esq.	3·23	·50	13	15	75·0	4	32·0	30
Coston Rectory, Melton	Rev. A. M. Rendell	3·29	·61	13	17	68·0	3	29·3	27
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	2·95	·52	23	13				
Castle Ashby	R. G. Scriven, Esq.	2·72	·65	28	18			39·0	29
Kettering	J. Wallis, Esq.	2·51	·61	23	17	67·0	3	42·0	25
Althorpe	G. S. Groom, Esq.	2·90	·72	28	15	65·0	7	33·0	29
Pitsford	C. A. Markham, Esq.	2·67	·70	28	14	73·0	3	33·0	29
RUTLAND.									
West Deyne, Uppingham	Rev. G. H. Mullins	2·95	·80	23	17	68·3	3	36·9	25
Northfields, Stamford	W. Hayes, Esq.	2·58	·58	23	14	60·0	1	33·0	15
Ratcliffe Observatory	H. E. Bellamy, Esq.	2·89	·56	28	15	68·0	3	40·3	24
Ventnor Hospital	W. T. Ryder, Esq.	3·46	·92	23	6	68·6	6	43·2	25
Altarnun Vicarage	Rev. J. Power, M.A.	5·17	1·00	9	16	76·0	7	35·0	1 & 30

The first week of September turned out dry and fairly fine, and there was another interval of similar weather between the 14th and 20th; with these exceptions, however, rain fell almost daily, and in sufficient

quantities to cause the total fall at most stations to exceed the average by from ten to twenty per cent. The 13th, 23rd, 24th, and 28th were the days of maximum fall, the heaviest record for one day, however, being 1·56 inches, on the 30th, at Stoke Bliss. There was much fog and haze, with heavy dews, in the latter half of the month. The barometer, on the whole, ranged high, but was unsteady. Westerly winds prevailed, with little sun. Owing to the continuance of unfavourable weather, the harvest was everywhere late. Although much corn was cut by the end of the month, it lay sodden in the fields. We have to go back to 1860 to find a similar record.

Natural History Notes by Observers.—*Haughton Hall, Shifnal.*—A very few wasps have at length appeared; Peaches attempted to ripen by the 30th; Figs hopeless; no Mushrooms. *More Rectory.*—The fruit crop is generally dwarfed in size and poor, excepting the nuts; Whinberries, however, have been abundant on the hills. I have not seen or heard of a Mushroom. *Cheltenham.*—Peaches and Nectarines on open south brick wall just ripe by the 27th; Brimstone Butterflies emerged from chrysalis on the 20th. *Uppingham.*—Crops and fruit very backward. There is a heavy crop of Plums, which, however, is only half ripe. Other fruit very bad. *Burton-upon-Trent.*—Horse-chestnut, Lime, and Birch began to shed their leaves on the 25th. *Spondon.*—*Œnothera Lamarckiana*, which usually blooms in June, did not commence flowering till this month, although close to a hothouse and facing south. *Altarnun.*—All hope of a peat harvest has been given up; scarcely any Partridges in N. Cornwall, except old ones; the young birds were drowned.

Correspondence.

Fossiliferous Bunter Pebbles in the Drift.—Well-rounded quartzite pebbles derived from the Bunter conglomerate occur in great numbers in the Chalky Boulder Clay of Leicestershire. Whilst examining this deposit in Mr. Townsend's brick-yard at Countesthorpe, about five miles south of Leicester, I broke open a liver-coloured quartzite pebble which contained a good specimen of *Orthis redux*, a well-known Lower Silurian fossil. In the "Geological Magazine" for 1878 (p. 239) I see Mr. Jennings records the same fossil in a precisely similar matrix from the vicinity of Nottingham.—W. J. Harrison.

Leptodora hyalina.—In reading over Mr. Graham's interesting paper on this remarkable animal, (page 225,) I could not help noticing one passage, which is most certainly incorrect. It runs as follows:—"Leptodora belongs to Baird's Legion Branchiopoda, Order II., Cladocera, Family I., Daphniadæ." Now this is obviously wrong, for Leptodora does *not* belong to the Cladocera, much less to the Daphniadæ. If Mr. Graham will turn to the definition of the order Cladocera in Baird's Entomostraca he will find that one of the most essential characters is that the limbs are all enclosed within the carapace. In Leptodora the limbs are all entirely free, and the carapace is almost atrophied. "How can these contrarities agree?" There is no need to say more than that if we attempt to reconcile it with the characters of the family Daphniadæ we fail utterly. Will Mr. Graham kindly let us know to what order and family Leptodora *does* belong? The so-called auditory organs are evidently antennæ. They are what Baird calls the superior antennæ, and in the male are long and spear-like. The long swimming limbs are the inferior antennæ, and the limbs marked d 1 to d 6 (Plate V.) are all true legs; d 6 is not an antenna.—Enquirer.

DAPHNIA BAIRDII.—Since I wrote my paper on this new Entomostracon, (see page 217,) I have been informed that the animal had been previously found near Berlin, and described by Schödler in his work entitled "Die Branchiopoden der Umgegend von Berlin," (Berlin, 1858,) under the name of *Hyalodaphnia Kahlbergensis*. There is no doubt, however, that it is a true Daphnia; and since it agrees in every particular with the characters of that genus given by Baird, I see no reason why it should be placed in a separate one. Schödler's specific name must, of course, take precedence of mine, by reason of its priority, and the name should then be *Daphnia Kahlbergensis*. I have the pleasure to record that this species has been found not only in Olton Reservoir, but also in Edgbaston Pool and Spurrier's Pool, and we may, therefore, hope to keep it amongst us not as an "illustrious stranger," but as a familiar friend.—H. E. FORREST.

SCARLET RUNNERS.—I have noticed but few rows of this useful vegetable during the present year which have borne anything like a moderate crop of pods. I presume it is primarily due to the abnormal character of the year, in the course of which we have had such a large number of wet days. This insalubrious weather also accounts for the absence of bees, which are necessary for the fecundation of scarlet runner bean flowers. The following extract from Dr. Darwin's "Cross and Self Fertilisation," p. 150, will, perhaps, prove interesting. He says: "The flowers of *Phaseolus multiflorus* are so constructed that hive and humble bees, which visit them incessantly, almost always alight on the left wing petal, as they can best suck the nectar from this side. Their weight and movements depress the petal, and this causes the stigma to protrude from the spirally wound keel, and a brush of hairs round the stigma pushes out the pollen before it. The pollen adheres to the head or proboscis of the bee which is at work, and is thus placed either on the stigma of the same flower or is carried to another flower. This plant grows well and flowers in Nicaragua, but as none of the native bees visit the flowers not a single pod is ever produced." Mr. Belt mentions a case ("Nature," 1875, p. 26) of a late crop of *P. multiflorus*, near London, which was rendered barren by the humble bees cutting, as they frequently do, holes at the bases of the flowers instead of entering them in the proper manner.—E. W. B.

Reports of Societies.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY.—September 24th. Mr. A. J. Shilton gave a very interesting paper upon "Illuminating Gas."—October 8th. Mr. C. B. Caswell, F.C.S., read a paper upon "Alkalimetry."—October 18th. The members visited the new railway now being made between Halesowen and Northfield.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—MICROSCOPICAL GENERAL MEETING.—September 16th.—Mr. T. Bolton exhibited a living specimen of *Ophiocoma neglecta*, the gray Brittle-star, from Llandudno. Mr. Wright Wilson exhibited a section of diseased liver stained with an aniline dye, which acted differently on the healthy and diseased parts so as to produce two colours. He also made some remarks on *Calveria hystrix*, a species of Sea Urchin found by Sir Wyville Thompson, at a depth of 445 fathoms, and presented to the Society the part of the Transactions of the Royal Society which contains figures and descriptions of the only perfect specimen yet found. Mr. J. Levick exhibited a new rotifer, *Anuræa longispina*, (see page 241.)—GEOLOGICAL SECTION.—September 23rd.—Mr. R. M. Lloyd mentioned the difficulty he had found in keeping alive the new Entomostracon, *Leptodora*, and

exhibited a cast shell of crab from his aquarium. Mr. Badger exhibited a very abnormally tasselled form of *Pteris serrulata*, grown by Mr. Chas. Williams, of Moseley Lodge, and read a letter about it from Mr. Thomas Moore, F.L.S. Mr. W. Southall read a paper on the making of the artificial sea-water for the Aston Aquarium. (See page 246.)—GENERAL MEETINGS.—September 30.—Mr. W. G. Blatch exhibited larvæ of *Vanessa Cardui*, remarkable only for their occurrence so late in the season; beautiful cocoon of a spider, *Ciniflo ferox*, in the shape of an egg, suspended by a silken cord; and a rare beetle, *Amara patricia*, new to the Midlands, found at Cannock Chase. Mr. W. B. Grove exhibited *Schizogonium murale*, from a wall at King's Norton. Mr. J. Levick read the paper on "A New Rotifer and Infusorian" printed at page 241. Mr. W. Graham gave an interesting account of a marine and dredging expedition organised by the Aberdeen University. Mr. H. E. Forrest reported that he had found *Ophrydium versatile*, a remarkable Infusorian, at Shrewsbury.—October 7th.—Mr. T. Bolton exhibited living male and female of *Leptodora hyalina*. Mr. J. Levick read some notes upon a curious Stentor, which he had found at Barnt Green. (See page 280 for description.) Mr. Montagu Browne, F.Z.S., read a paper "On the Desirability of Establishing a Museum in Birmingham, with some remarks on the Collection at Aston Hall." He characterised the latter as a collection of caricatures of nature, huddled together without even a pretence of scientific arrangement or correct nomenclature, and propounded the following scheme for the establishment of a scientific museum, centrally situated, and equally instructive to the student and the mere sightseer. That two moderate-sized rooms should be obtained, in one of which should be collected specimens illustrating the fauna, flora, geology, and mineralogy of Great Britain, with especial regard to local natural history. That these should be mounted with characteristic surroundings (*i.e.*, rock birds on rocks, waders in marshy ground, &c.) In the second room might be arranged groups of animals, &c., such as were likely to be of use for educational purposes. He said that if the two rooms were provided and fittings obtained by public subscription, the objects would be speedily forthcoming; indeed, that he himself was prepared and willing to present them with a large number of British birds. At the conclusion of the paper, a discussion took place; in which Messrs. E. W. Badger, W. R. Hughes, W. Wright Wilson, H. E. Forrest, R. W. Chace, and J. Levick took part, all the speakers substantially supporting Mr. Browne's suggestions.—BIOLOGICAL SECTION.—October 14th.—Mr. J. Bagnall exhibited *Medicago denticulata*, *M. maculata*, *Lolium temulentum*, and *Bromus patulus*, from a farmyard at Kenilworth; he considered all of them to be casuals introduced with foreign seed. *Riccia glauca* and *Anthoceros punctatus*, Hepaticæ from a marly field at Leek Wootton. The peculiar distinctions in fruiting characters were pointed out and microscopical preparations of them were exhibited. Mr. J. G. Cotton exhibited Eye of Trilobite, *Asaphus caudatus*, from the Wren's Nest, Dudley. Mr. J. Bagnall then read his report of the Botanical Section of the Falmouth Excursion, in which he stated that upwards of 400 species of flowering plants, grasses, and ferns had been recorded or collected during the excursion, the greater part of which were found in the Falmouth district, (Falmouth to Helford, a distance of about six miles,) most attention having been given to this neighbourhood. Each day's excursion and proceedings were then duly recorded, and the most noticeable plants found during the excursion were exhibited. An account was also given of the excursion to Land's End and Lizard Point, and the rare plants taken on that occasion were exhibited. The geographical range in Great Britain of each plant exhibited was given, and an analysis of the whole flora of the district worked, so far as represented in the list made during the excursion, was given, as follows:—220 belong to what Hewett C. Watson calls the British type of distribution, or to that intermediate type which he designates British-English, *i.e.*, species widely spread through South, Middle, and North Britain; 150 to what Hewett C. Watson calls English type, or to that intermediate type which he calls English-British, *i.e.*, species chiefly seen in South or South Middle Britain; seventy to what he calls the Atlantic type or species, chiefly seen in West England; twenty to the Germanic type or species, chiefly seen in East England; four are what he designates local species, and are confined to single or few counties. The paper was illustrated by sixty-eight specimens of the plants collected.

BIRMINGHAM PHILOSOPHICAL SOCIETY.—The annual meeting of the members of this society was held on Thursday, October 10th, in the Board Room of King Edward's Grammar School, Birmingham. Dr. Heslop (the president) presided. The Rev. H. W. Crosskey (one of the hon. secs.) read the annual report, which stated that the number of members was 118. During the year there had been three withdrawals and twenty-four new elections. Dr. Heslop was re-elected President. The other officers having been elected, Dr. Heslop delivered the annual address. He proposed to ask their attention that evening to the life and poems of Lucretius. The sum of Lucretian philosophy was that all things sprang spontaneously from matter, and that out of the concourse of atoms, their varied motions and combinations, all the phenomena of nature arose; that the mind, soul, and body came into existence, developed, and died together; that the sum of things was fixed; that by infinite adaptations ever going on some things disappeared, or rather were restored again into the primal elements, while other things came into existence and maintained themselves; that there might be gods dwelling in the upper ether, but that providence was not their function, the universe being self-dependent. Finally, that the laws of nature were eternal and inviolable, the monsters and chimæras of mythology being idle tales, and that the punishments fabled to be in store for us in a place of torment "do all exist for us in this life." Lucretius had no conception, or but the dimmest conception, of those forces which play so great a part in modern science, much less of their relations to each other. He ascribed far too serious a part to the fear of death as a motive influence on man's mind; and he seemed to be unaware, as many modern writers on the same subject seem to be unaware, that the views of death held by persons in their health and strength are very different from those held by the same persons when afflicted by pain, disease, or moral suffering. Especially Lucretius exaggerated fear of the gods and of death as the chief basis of the religious emotions. He was apparently unconscious that these emotions are intertwined with our nature under all conditions of human life, altogether irrespective of the origin to which he ascribed them. The most ardent faith in the existence of a supreme First Cause, and of our dependence on that Being, was able to exist in the same breast which knew no fear of death. The greatest fault of Lucretius was his confidence in his theories, as offering complete solutions of the problems of life and nature. When he left the mysteries of matter, motion, and death, Lucretius planted his foot on surer ground. There they were free to admire a descriptive power, an insight into nature, a vigorous handling of man, life, and society, not equalled by any ancient author excepting Homer. Lucretius loved to think of nature as free from the dominion of her proud lords; he loved to think of men as free from degrading superstitions. Yet even he was obliged to admit that the first beginnings of things swerved, though ever so little, from their lines of motion, and so made the phenomena of the world possible. He admitted that varied deities dwelt in the bright ether, above the gliding signs of Heaven, though he refused to believe in their power or their desire to influence the course of nature. He saw as intensely as the most orthodox believer, that when men deviated from justice, gave themselves up to ambition, or yielded to their passions, the conscience was able to punish them with a severity equal to that inflicted on the fabled tenants of Tartarus; yet he did not admit that this inner monitor reposed on any external sanctions. This, then, was the compromise effected, doubtless after painful struggles and much thought, in the mind of Lucretius between the popular religion of his day and his knowledge of the facts of life and nature. It was not for them to say whether his standpoint was correct—whether the reconciliation he arrived at between the sensuous and the supersensuous was a logical reconciliation. If it was correct for him, they were precluded from denying its validity. The conscience of each investigator was his only court of appeal. If a man's conscience was to be his guide and his strength, it could only be strong and helpful when it was kept in constant work. It was probable that the exercise of external authority over it might yield a crop of hypocrisy; it was impossible that it could give a stock of strength. Here, to dominate was sooner or later to drown. An eminent scholar, educated in the school in which they were assembled, lately told a notable congregation in Westminster Abbey that "every fact which is added to our knowledge of man or of the world illuminates our knowledge of God." This

was a reflection which he gladly left in their minds as he took leave of Lucretius.—On the motion of the Rev. A. R. Vardy, seconded by the Rev. H. W. Crosskey, a hearty vote of thanks was accorded Dr. Heslop for his address.

BURTON NATURAL HISTORY AND ARCHÆOLOGICAL SOCIETY.—September 27th.—An afternoon trip to Egginton and Etwall completed the excursion programme for 1879. Mr. R. Thornewill acted as the leader, and the party numbered about forty persons. Arriving at Egginton Junction, the party proceeded to the church. The members duly examined the objects of interest in the church, and the leader discoursed upon its history and architectural features. The building is supposed to have been erected about the year 1300. After visiting the gardens at the hall, the party went to Etwall. In the churchyard there is a fine old yew tree and some beautiful elms, and in the adjoining vicarage grounds are two magnificent specimens of the latter, known to have been planted in the year 1701. Two gravestones were pointed out as having been erected at the heads of their intended graves by two eccentric parishioners some years before their decease. Each stone had a full inscription engraved, leaving space for the dates and ages. Both persons are now buried, one very recently, and in the other case the final particulars are not yet inserted. On visiting the church the register was first inspected. Commencing as far back as 1558 there are many entries of quaint interest. The most curious feature, however, is the register of burials under the Woollen Act, 1678 to 1681—an Act passed to compel all persons to be buried wrapped in woollen, in consequence of the depressed state of the woollen trade. In each case the relatives of a deceased person had to make an affidavit before a magistrate that the Act had been complied with, and there was a penalty of £4 for setting at nought this ultra-protectionist enactment. The church belongs chiefly to the "Perpendicular" period. There is a stone lectern, and in the south windows are some remains of fourteenth century glass, representing the three persons of the Trinity, and St. Helen, the patron saint of the church. There are brasses to the memory of the Port family in excellent condition, bearing date 1557; also a fine raised stone tomb, beneath which lie the remains of Sir John Port, the founder of Etwall Hospital and Repton School, also his first and second wives. The party adjourned to the Hawk and Buckle Inn, had a capital tea, and then a formal meeting was held, at which new members were nominated. The *Burton Chronicle* makes the following remarks on the work of this active society:—"It may be remarked that the Natural History and Archæological Society has thus far achieved an undoubted success in its operations. There is probably no other organisation in the neighbourhood that is fulfilling so useful a mission. Pleasure and profit are combined in a pre-eminent degree. The summer excursions make one familiar with objects of interest in the neighbourhood, which might otherwise have remained unnoticed and unknown to very many. It is something to visit old churches, and halls, and battlefields, and so call up the times and the circumstances in which our ancestors lived, and so compare the past with the present; it is something to search deeply into the hidden mysteries of nature and read the testimony of rocks, the language of flowers and plants, and discover more fully the Divine handiwork in the world of animal and insect life; it is a further advantage to leave for a time one's daily round of labour and step out from the narrow world of ordinary life into a larger and freer atmosphere. Nor are the winter operations of the society of less importance, for in the evening meetings there are presented for consideration subjects of the deepest import concerning various branches of science in the province of the society's work. There are a few people who affect to ridicule such researches and speak somewhat scornfully of beetle and butterfly collectors. Let them do so if they will, and so close their eyes to nature's marvels and their ears to the many Divine voices around them. A reverent naturalist prefers to say—

> To me the meanest flower that grows may give
> Thoughts that do lie too deep for tears.

The same sentiment is equally true of God's creatures, even the smallest, and the history and habits of any one of them fill a page in that glorious book of nature, which is, as Lord Bacon has well said, simply 'the word of God revealed in facts,' and these facts are interesting and profitable to the intelligent and thoughtful of every class of the community."

CARADOC FIELD CLUB.—September 25th.—A special meeting for the study of cryptogamic botany was held at the Wrekin. The morning was very inclement, cold, and wet, and heavy rain continued during the greater part of the day. Consequently only some six or seven members assembled at Wellington station, where they were met by Dr. Callaway, Rev. W. Houghton, and Mr. R. Anslow. The weather prevented much search for the special objects of the meeting, and the day was spent in examining the geology of the hill, on which Dr. Callaway's recent labours have thrown so much new light. After the annual dinner at the George Hotel, Shrewsbury, papers were read by the Rev. W. Houghton "On the Common Liverwort," and by Mr. T. P. Blunt, "On some relations of Light to Vegetation."

CHELTENHAM NATURAL SCIENCE SOCIETY. — At the annual meeting held on Thursday, the 2nd October, Dr. T. Wright, F.R.S., was re-elected president. The first ordinary general meeting was held on Thursday, October 16th, when, after the usual business routine, the President gave a short address, stating the use the Society had already been to the town of Cheltenham, noted the progress it was making, and urged on his hearers to take up some special subject of natural history. He ended by giving an outline of the proposed arrangements for the formation of a library in connection with the Society, and then introduced Col. Basevi, who read a paper on the "Structure of Mosses," which was well illustrated by diagrams and over 200 mounted specimens of mosses from various parts of the world. Col. Basevi exhibited under the microscope various slides showing parts of the structure of mosses. Some of the objects, showing the fructification, had been, he stated, kindly given to him by the Rev. J. E. Vize, of Forden.

NOTTINGHAM NATURALISTS' SOCIETY.—October 1st. Mr. B. S. Dodd read a paper on sponges. He pointed out the special arrangement of the sponge to bring about a current by inhalant and exhalant apertures, the inhalant being called pores, the exhalant oscula. The mode of reproduction was illustrated by diagrams showing the peculiar arrangement of a gemmule of the fresh-water sponge (*Spongilla*). Specimens of horny and siliceous sponges were exhibited, and likewise an oyster-shell perforated by the boring sponge (*Cliona*). Various orders of the second sub-kingdom, Cœlenterata, were referred to, but especially the order Hydrida, of which *Hydra viridis* was taken as a type. Medusæ were in some instances shown to be reproductive buds of one or other species of Hydrozoa. A discussion followed.—October 15th. Mr. A. H. Simpson gave a lecture on water, showing how, by electricity, it was resolved into its two gases, the oxygen appearing at the positive pole, hydrogen at the negative one, and concluded the experiment by showing how it was reproduced from the same elements by an electric current. The power of water, as water and as steam, was explained, and how its evaporation and collection in the clouds was the cause of rain. Its expansion on being converted into ice and the advantages resulting therefrom, both physically and economically, were next noticed. Various experiments with each of its two constituent gases were performed, to the surprise and amusement of the audience. The construction of the lime-light was fully explained, by which a number of views of the Falls of Niagara, representing winter and summer, were shown on a screen.

OSWESTRY AND WELSHPOOL NATURALISTS' FIELD CLUB AND ARCHÆOLOGICAL SOCIETY.—The last excursion for 1879 took place on Tuesday, September 30th. The meeting place was Newtown, famous for its trade in Welsh flannel, a prettily situated town on the banks of the Severn. After a visit to the ruins of the old church, the route lay over some very hilly country to the village of Kerry. Here there is an interesting old church, in which is a monumental tablet to Giraldus Cambrensis, the antiquarian. Close to the Vicarage there is a fine camp, and two tumuli in a field just outside the village. The whole neighbourhood abounds in entrenchments, ditches, camps, tumuli, and other similar relics of antiquity. The scenery about Kerry is very picturesque. There is a branch line from Abermule Station on the Cambrian Railway to Kerry, by which the party returned to Oswestry.

THE DIPHTHERIA FUNGUS.*

BY THE REV. J. E. VIZE, M.A.

I wish to direct attention to a fungus doing its deadly work not in the vegetable but in the animal kingdom, namely, diphtheria, which certainly is fungoid, and belongs to an ally of *Peronospora*, namely *Oidium*, under the order Mucedines. It might possibly be thought strange that I, a parish priest, should be arrogant enough to refer to a subject which certainly would far more readily and easily be treated by some one in the medical profession. But sometimes this disease comes so near to one whose work is not medical that we must attend to it whether we like it or not. Such has been my duty lately, for my parish has had diphtheria in it since last October, and the National Schools have been closed for several weeks and are likely to be for some time. There have been several deaths amongst the children, although the great majority of the attacks have been light. Those light attacks seem to be really the most subtle and dangerous, because the sufferers are not isolated and are therefore liable to spread the disease. It should not be forgotten that, generally speaking, the first outbreaks are light; and why? Speaking not from a medical but from a botanical point of view, the answer is very easy. The fresher the spore, (the seed,) the more vigorous it is. Hence, if an attack comes from an enfeebled spore, the virulence of the growth is quite weak compared with that from a spore recently communicated from a patient.

When the medical officer, Dr. Thursfield, called upon me to urge the closing of the schools, we became mutually interested in the diphtheria question, and the doctor urged me very strongly to investigate the diphtheria *Oidium*. It was arranged that some of the diphtheria fungus should be sent to me, and this was done with every possible measure of precaution to avoid the risk of contagion. Having received the fungus, I mounted some for microscopical examination, and then found that the specimens showed unmistakably an *Oidium* growth. In the manipulation of the slides every precaution was taken to prevent the escape of even a fragment of the fungus. And here I would point out the great importance of precautionary measures whenever diphtheria breaks out. I would particularly urge the burying or burning of all linen used by an infected person; for a frightful source of the spread of diphtheria is the use of pocket handkerchiefs, &c., which, even after washing in cold water, might still contain the spores of *Oidium*—and these are the germs of the diphtheria fungus. As a rule these germs are only the elementary states of higher fungi; for various species of *Oidium* develop into different kinds of blight. It was to find out the more highly developed fungus of the *Oidium* of diphtheria that I have run the risk of having it sent to me; and if I or my co-workers could discover this, we

* Part of a lecture delivered at Chester, January 30th, 1879.

should be doing good service. The spores are so minute that 6¼ millions of them would lie upon a square inch of writing paper.

By some it is supposed that diphtheria is caught from cows suffering from "garget," and is communicated with the milk; to such I would say —examine under the microscope the milk from a cow thus diseased, and if there be any spores in it just like the *Oidium*, then you have safe ground on which to go. My own notion is that "garget" has little or nothing to do with diphtheria; but, if it has, then it would seem likely that the spores of *Oidium* were eaten by cows in herbage near the mouths of bad drains or such like spots, and so passed through their system and into the milk. I believe that the cows may be left out of the investigation, and that in certain seasons there will be outbreaks of the illness because those seasons are, from atmospheric conditions or other causes, favourable to the more abundant growth of the *Oidium* in drains. When that takes place the spores escape into the air, and are carried about in all directions; but are not (even when they reach the throat injurious to anyone unless the throat is ripe for their development. One prolific source of the disease is bad drainage. A surveyor examining a sewer from which diphtheria had broken out was seized with the disease and suffered severely. The *Oidium* was in that sewer, and most likely had produced its resting-spore, according to the gradation of seasons. In the drains you may look for it; destroy it you never will; but you may possibly check its severity. No one ever caught the illness yet without the *Oidium* or a riper stage of the fungus being present. No sore throat can produce an attack of diphtheria unless the fungus is there. Some people seem to think that these growths come of themselves, but it is utterly impossible that they can. Do trees or flowers spring up spontaneously? or is spontaneous generation the source of animal life? All would deny this. But it may be asked—How is it that, if these fungus-spores abound in the air, they are so eccentric in their choice of throats in which to grow? The reply is very simple. Hundreds of acorns fall in the autumn from one tree, and how is it that so few ever grow? The fact is, they do not meet with a spot just suitable for germinating, and cannot grow. So with the diphtheria fungus; many thousands of people may inhale the spores, but their throats may not offer the conditions necessary for growth.

Then, again, with regard to the development of the disease. There might be several children attacked in one house, some get well easily, others with difficulty, others die. How is this? The solution might be, and probably is, that their throats were more or less ready for the growth of the *Oidium*. According to the state of the throat, so the disease is intensified or not. It is very singular that the fungus is so apt to attack children, as compared with adults; the Medical Officer of my own parish has recorded that 71 deaths out of every 100 are those of children between one and ten years. The feeding grounds, the dens of infection, are schools (especially National Schools) and workhouses, because therein children congregate so much.

There is one point in which some of you may perhaps be able to help me. The diphtheria fungus grows in the mucus of the throat, at the top or some distance down the trachea. Existing in so moist a habitat, how is it that it is so contagious? I can understand the spreading of the spores by carelessness in the use of pocket handkerchiefs and the like; but I cannot understand how a child's breath or a corpse can carry the spores about, unless when there is an absence of moisture altogether and the spores escape when dry, after evaporation has taken place.

I hope that none will carry away the idea that fungi are, as a rule, so hurtful in their work as might be supposed from what I have said of this one form. They are often mighty instruments in arresting disease and death, although they sometimes destroy life. Nevertheless the rule is certainly not to hasten death, but to keep health. Animal life could not be prolonged to anything like the proper extent if it were not for the despised moulds, which teach us that purity is a grand reality, for what would the half-drained sewers and damp places be if the *Oidium* of diphtheria did not in its growth imbibe for its own existence the poisonous gases which otherwise would be insufferable? We are thus taught lessons which it will be to our cost if we do not follow. We are taught that animal and vegetable refuse must not lightly be permitted to accumulate; the sooner it is applied to its real use, namely, the enriching of the soil, the better. Soil deodorises, economises, and profits by these refuse materials; they are the very things which the earth requires.

ENTOMOLOGICAL RAMBLES IN THE MIDLANDS.

II.—CANNOCK CHASE.

BY W. G. BLATCH.

(Continued from page 196.)

Next in order of importance to Bewdley Forest as a resort for Midland Entomologists must be reckoned that extremely interesting district known as "Cannock Chase." Situated almost in the heart of Staffordshire, and covering a very considerable portion of the extensive area lying between Lichfield, Penkridge, Stafford, and Rugeley—easily accessible, withal, from any of those stations—the "Chase" ought to be better known to local Naturalists than it seems to be. Those who have visited it need no recommendation of its attractions, but to those who at present are strangers to that region I would say: "Go, take a half-holiday as soon as you can, and spend it there." But as, I suppose, for the purposes of these papers, I am, for the time being, "Guide, philosopher, and friend," I must not only point to the goal, but lead the way. We will, therefore, if you please, consider ourselves as fairly started on our second Ramble. As he "who hesitates is lost," we will not bewilder ourselves by discussing the various routes by which our chosen ground can be explored, but at once decide to attack it from Rugeley,

This will be attended by the additional advantage of admitting of friends from other districts joining our party at the Trent Valley Junction. Crossing the Trent and passing through a part of the town, we are soon in the open country, the wide stretch of undulating heather-clad ground before us indicating unmistakably that we are on the very threshold of Cannock Chase. As we press on, eager and hopeful, we are struck by the peculiar features of the spot, forming as they do a perfect contrast to the scene of our first Ramble. Instead of dense woods hemming us in on every side, we have before us an extensive moorland tract, covered with heather and bracken and a thick carpet of bilberry, cowberry, and crowberry, the only woodland features being, now and then, a straggling thicket of haggard, storm-torn birches, and, in the distance, a long, narrow strip of coppice, known as the "Huntington Belt." Boggy ground is not uncommon, whilst here and there we come upon a bright sparkling streamlet dancing merrily along its pebbly course.

At Bewdley, we were so hemmed in by copse on copse, piled in massive and silent grandeur around and above as far as the eye could scan, that frequently the absence of "air in motion" affected us in a way and to an extent scarcely credible. In the midst of our sport, almost gasping in the stagnant, humid air, a feeling of solemnity has suddenly sprung up in our minds, as if the guardian spirit of the region had, in passing, touched us with his invisible form, and evolved sensations of mystery and awe from the depths within. Here, on the contrary, where sportive breezes seem perpetually to play, languor is unknown, and we tread the springy soil with a buoyancy and freedom almost ethereal.

But not only do we notice a change of soil and landscape, even the insects are, for the most part, of types divergent from those to be found at Bewdley. This is, of course, only what might be expected from the totally different conditions under which they exist. Our method of procedure must also be altered to suit our new surroundings. The umbrella (for beating into) and the sweeping-net are useless encumbrances here, but the digger and knee-pad are absolute necessities. The digger (a strong fern trowel is best) will save the fingers in turning over stones and refuse, the knee-pad (of stout leather) will save the operator from headache and backache, and will prevent the knees and trousers being cut by sharp pebbles. As was the case in describing our Bewdley Ramble, we have not time to do more than merely hint at the charms of the "chase" to sightseers, but must limit ourselves strictly to the entomological features of the locality. The novelty of the "first view" having worn off, and having satisfied ourselves that our *instrumenta belli* are effective, we proceed to explore this "fresh field," in the hope that the result will prove it to be another "happy hunting ground." At first we see only a few common species of moths and beetles, the Heath Moth, *Fidonia atomaria*, being, from its abundance, a perfect nuisance, and the dull, puffy *Adimonia suturalis* dropping in hundreds from the heather at the slightest touch. Look into this drain-hole by the roadside, and see how thickly these beetles, alive and dead, strew the bottom. They have, evidently, fallen over the sides, and are too lazy, or too stupid, to make

their escape. Under a solitary oak tree are some insects flying in a curious manner; we catch a few and find them to be the "Rusty Gun-barrel," *Athous hæmorrhoidalis*, a beetle of the Skip-jack tribe. The "Fox" and the "Emperor" moths are dashing about with their usual swiftness and irregularity, as if madly and vainly trying to escape from demons of the air that confront them at every turn. About those bright green patches, indicative of the triumph of the bilberry over its less vigorous plant rivals, swarms of green Hair-streak Butterflies, *Thecla rubi*, flash about in the sunshine; and it is amusing to watch their evolutions and to note how, in certain lights, they become quite invisible. This butterfly is a perfect mimic. With its wings open it resembles the darker foliage and the russet soil; with its wings closed it cannot be distinguished from the green leaves of the bilberry, upon which it delights to settle, and you would certainly pass it by, only that it betrays itself by flying up as you approach. But here is work for the digger, to turn over these stones strewed about the turf. What numbers of *Bradycellus cognatus* and the pretty little *B. similis!* Here are also, though less commonly, their congeners, *B. distinctus*, *B. verbasci*, and *B. harpalinus*. What is this beetle, looking somewhat like a giant *Dyschirius?* It is shiny, bronze-black, beautifully rounded in outline, its thorax being almost globular, and its abdomen oval, and looks altogether like an insect of "high degree." Its name is *Miscodera arctica*, and this is a new locality for it, the most southern one yet discovered. Another prize. This time it is *Cymindis vaporariorum*, like the preceding a mountain species and rather rare, taking its day-rest under a paltry piece of old shoe leather! Thus we find another species new to the district, and at the same time learn an important lesson in beetle knowledge, viz., that under the smallest and most unlikely bit of rubbish may lurk an insect prize! "It never rains but it pours." Here is another red-letter capture, and a beauty it is too. How it gleams in the sunshine, its changeful tints resembling the effects of shot-silk, only that they are more gorgeous. What long deep lines mark the base of the thorax, and altogether what a lovely outline it bears! It can be nothing else but the very desirable *Pterostichus lepidus*. Satisfied of this, we eagerly hunt for more, and find them, too, both males and females, the latter having their elytra duller and more softly silky, the thorax showing a brighter coppery appearance.

The generally common species of *Pterostichus* seem to be entirely absent, even the ubiquitous *P. cupreus* not showing up; but here are a pair of *P. versicolor*, which we of course capture. This insect is regarded by some Coleopterists as being a variety only of *P. cupreus*, but having examined a considerable number of specimens in which the diagnostic characters appear distinct and constant, I have no doubt about its being a good species. The genus *Calathus* is well represented, the following species being found freely:—*C. cisteloides*, *C. flavipes*, *C. melanocephalus*, with its variety, *nubigena*, and *C. piceus*. Considerable dexterity is required for the capture of these beetles, (especially the shiny and quick *C. flavipes*,) which "screw" themselves into the soil before you have time to see fairly what they are.

This seems to be a rich field for *Geodephaga*. Besides those already named, we have secured a fine series of the beautiful though common *Cicindela campestris*, including some striking varieties, bronze instead of green, and having small black specks on the elytra in place of yellow spots. *Dyschirius globosus*, *Patrobus excavatus*, *Taphria nivalis*, and *Olisthopus rotundatus* occur in abundance, as also do many species of *Amaræ* and *Harpali*. Of *Amara fulva* we pick up two, and are fortunate enough to secure three examples of the rare *A. patricia*. Amongst the small pebbles in the roadway *Bembidium lampros* (the variety *velox* occurring sparingly,) *B. brunnipes*, and *B. femoratum* abound. Upon lifting a larger stone we are gladdened with the sight of two beautiful beetles and a rare moth, the former being *Corymbites æneus*, male and female, one a dark bronze, the other a deep blue, and the latter the Glaucous Shears Moth, *Hadena glauca*.

Pressing on over the moor in the direction of the Huntington Belt, we reach "Deakins' Grave," 760ft. above sea level. Here we pick up the variety *griseus* of *Harpalus ruficornis*, and a dead and damaged specimen of *Nebria Gyllenhalli*, two northern insects; more *Miscodera* and *Pterostichus lepidus* turn up; also a very fine example of *Calathus nubigena*.

But we must push on through the heather towards Hednesford. As we go we start up great numbers of the very beautiful little moth *Anarta myrtilli*, together with hosts of "Crambs" and other moths.

The pool seems full of water beetles, and on the margin we find many species of *Geodephaga* and *Brachelytra*. At one end, on the leaves of *Polygonum amphibium*, are to be seen hundreds of specimens of *Galeruca nymphea* in all stages of development, and under a dead dog occurs a fine fresh specimen of *Silpha opaca*.

Our way now takes us over a not very interesting part of the Chase towards Norton Bog and Reservoir. The walk pulls the "kinks" out of our legs, and on arriving at the Reservoir we are prepared for more work. Close to the margin of the water is a mass of rubbish washed up by the "waves;" we turn it over, and are rewarded by seeing *Carabus nitens*, perhaps the most strikingly coloured of all the British *Carabidæ*. It is accompanied by *C. granulatus* and several *Anchomeni*, including the handsome but common *A. marginatus*. Amongst the gravel we take quite a host of *Bembidia*, this being apparently the favourite locality on the Chase for the very interesting little beetles comprised in this genus. The following species of *Bembidium* fall victims to our prowess: *rufescens*, *obtusum*, *biguttatum*, *æneum*, *guttula Mannerheimi*, *quadrimaculatum*, *quadriguttatum*, *articulatum*, *lampros*, *nigricorne*, *bipunctatum*, *decorum*, *monticola*, *brunnipes*, *tibiale*, *atrocæruleum*, *femoratum*, *littorale*, *flammulatum*, and *punctulatum*, not by any means a bad day's sport in themselves, even had we "bottled" nothing else. But there are a few more things yet to be added to our list. By digging in the marly bank we turn out two or three specimens of the ludicrously awkward *Nebria livida*, very interesting as occurring in the Midlands, the headquarters of this beetle being on the coasts of Yorkshire, Norfolk, &c.

A short distance furthur on our diggers bring from their hiding-places three beautiful specimens of the rather rare *Trechus brunneus*.

Our time has now nearly run out and we must think of returning. Before leaving this spot, however, we turn over one of the drowned dogs lying about, and pick out a supply of the Histers and other Clavicorns that have taken possession of his carcase. But though there are plenty of beetles we are soon glad to retreat, the "high" state of our quarry being too much for at least one of our five senses. We therefore hasten towards Brownhills Railway Station, with the view of catching the next train homeward. On the way we capture *Carabus arvensis* running on the heath, *C. catenulatus* under a stone, and a single specimen of a pine-feeding weevil—*Hylobius abietis*—which seems to be altogether out of his reckoning here. This beetle suggests a topic for conversation, and our journey home is bereft of much of its tediousness by an animated discussion on the migrations (both local and general) of insects. Our second Ramble thus ends as happily as did the first, and our party separates with evident signs of unabated energy, indicated by the eager enquiry, "Where shall we go next, and when?"

NOTES ON THE STRUCTURES OF PITCHER PLANTS.

BY LAWSON TAIT, F.R.C.S., PROFESSOR OF ANATOMY TO THE BIRMINGHAM ROYAL SOCIETY OF ARTISTS, ETC.

(Continued from page 268.)

SARRACENIÆ.

Of this family Dr. Hooker makes two groups, in the first of which the lid does not cover the mouth of the pitcher, whilst in the second the lid does not admit rain to the pitcher. These groups are united by the fact that in some of the first the lid covers the mouth of the pitcher in the young state of the plant, but does not do so when the plant is old.

In *S. purpurea* the lid never covers the pitcher, and to this plant I first directed my attention, for it seemed to me that it would prove to be in organisation the least removed from a mere water pitcher. I examined many specimens of this plant, some grown under glass in this country, and some brought living from its native soil. My observations on the structure may be summed up in the description of a mature pitcher of a native-grown plant, nine centimetres in length. The outer surface was scattered with stomata and multifid buds. From the margin of the lip down the inner surface of the true pitcher, for a distance varying between two and three centimetres, the epithelium is of peculiar shape, known as sinuous. On this zone stomata are very abundant. There are numerous stiff hairs, not tubular, but made up of long rod-like cells. (Plate VIII., Fig. 9.) These setæ are all pointed downwards, towards the cavity of the pitcher, and must, evidently, be of service in preventing the egress of insects who may wish to travel outwards. It would be very interesting to know what special appliances enable

Xanthoptera semicrocea and *Sarcophaga sarraceniæ*, said by Professor Riley to be the only two insects which can escape from the pitchers of the Sarracenia, to overcome this formidable *chevaux de frise.* In the case of the latter insect it is probable that the grub is deposited in the pitcher by the mother before the special armature of the first zone is developed. This development afterwards leads to the peculiar method of escape of the mature grub in a way serviceable to the plant in which it has fed. Sparsely scattered over this surface are multifid buds, raised above the epithelial level for the greater part of their bulk, but slightly dipping below it, being therefore transitions from the multifid bud to the ostiole. I have failed to find anything which I could regard as nectaries on this surface. It ends quite abruptly in a line of crescentic markings, armed with stunted-setæ, and when wetted it does not throw off water. (Fig. 9.) The second zone presents to the naked eye a remarkable bald appearance, and when wetted it throws off the water, a circumstance which seems to be due to a peculiar arrangement of the epithelium. Each cell is produced into a mammillary process, (Fig. 9,) pointing downwards, and is marked by a number of flutings, like the back of a pecten shell, these flutings converging towards the apex of the process. The process of each cell overlaps the upper margin of the cell immediately below it, and in this way a subsidiary barrier is formed which must prevent the egress of insects small enough to creep between the large setæ of the first zone. On this surface the intercellular spaces are evidently canalicular, and multifid buds abound, but they are covered by the altered epithelium. Whether this covering means that they are only hidden by the peculiar development of the epithelium, or are really embedded, I am unable to say. This zone is about six millimetres wide, and ends as abruptly as it begins. I have failed to obtain any evidence of secretion from this surface, and therefore I regard its glandular structure as purely absorbent. Stomata are of very occasional occurrence on this surface. In the third zone the epithelium is of the sinuous pattern, with well marked intercellular canals and very abundant included glands. These bodies are entirely covered by the epithelium, the divisions of their protoplasm appearing, however, very close under the surface. They are about ·065 of a millimetre. There are no stomata on this surface. The transition from the third to the fourth and most extensive zone is rapid, but not quite sudden, and consists in an alteration of the cells of the epithelium from the sinuous shape into irregular polygons. The subepithelial cells are, however, of the sinuous shape, a fact which may account for the view expressed by Dr. Hooker, that this fourth zone has no cuticle. There are no stomata to be found in this zone, and no subepithelial glands, the place of the latter seeming to be taken by the tubular trichomes already described. These trichomes are not nearly so stiff and strong as the setæ on the first zone, and the surface on which they are situated is peculiarly retentive of water, the innumerable hairs taking it up between them like a sponge. I have not seen spiral vessels in the tissue of *Sarracenia purpurea.* All my efforts to discover the presence of any ferment having digestive properties in the fluid taken

from *S. purpurea* have failed. Fluid taken from pitchers containing insects generally gives a distinctly alkaline reaction, and in the few instances where I have obtained a faintly acid reaction, it has seemed to me to be due to the presence of ants. In virgin pitchers, fed with albumen, no acid reaction has ever been obtained, and the albumen rapidly decomposes. I may here state that the ordinary method of testing these fluids by litmus paper is crude enough not to be always trustworthy. A more delicate way is to make a concentrated solution of litmus in distilled water, and add to it about ten per cent. of absolute alcohol. A drop of this should be placed on a white porcelain plate, side by side with a drop of the fluid to be tested, and the drops then made to touch. An amount of acid may thus be detected which will escape the eye of the observer if litmus paper be used, and there can be no possibility of error. I draw the conclusion, therefore, that the glandular structure of *S. purpurea* is purely absorbent, that its pitchers are merely passive insect traps, and that the advantage gained for the plant by the destruction of flies is to be attributed entirely to their maceration. Another argument in favour of this, the importance of which will be seen by and by, is that flies continue to live an indefinite time after having been introduced into a Sarracenia pitcher containing fluid. The very interesting observation of Prof. Riley concerning the habits of the *Sarcophaga sarraceniæ* would show that considerable advantage is gained for the plant by the direct application of the insect debris to the roots of the plant. I am quite certain from my experiments with the nutrition of Nepenthes that if *S. purpurea* had a secretion at all like it, no insect could visit the latter with impunity. A series of experiments made during the summer with test tubes of various sizes and diameters, and containing fluids of various kinds, have convinced me that as far as the common house fly is concerned, no specially disguised or attractive form of trap is required. But there is no doubt that the addition of the coloured venation on the lip of the *S. purpurea* must make it more attractive to certain kinds of insects, as Sir John Lubbock has shown that bees are greatly influenced by colour. The armatures of the upper zones must also be advantageous by imprisoning the insects. It will be seen, then, that I differ from Dr. Hooker in that I regard the first and second zones of the *S. purpurea* as the truly detentive surfaces, and the third and fourth as absorbent.

S. flava.—I examined the pitchers of a young plant in which the lip covered the mouth of the pitcher. If I may argue from the facts observed in Nepenthes this ought to be the most active condition of the pitcher. I found spiral vessels in the lid, and numerous stomata and ostioles. The latter in this case suggested that they may be the local centres for the growth of epithelium, for the cells in their immédiate neighbourhood were all small and seemed to radiate from the ostiole as from a centre, and the intercellular canals seemed to grow with them (see Fig. 7, also Fig. 4 from *S. rubra.*) There were also a few multifid buds. The first and second zones of this pitcher resemble those of *S. purpurea*. The third has short tubular trichomes and no glands, and the fourth has long tubular trichomes. This variation in the third zone is noteworthy. I found no evidence of secretion here, and when the pitcher was over-fed, whether by albumen or naturally by a too large fly, the decomposition spread to the parenchyma of the leaf and killed it.

[TO BE CONTINUED.]

SCIENTIFIC NAMES.—II. PRONUNCIATION.

· BY W. B. GROVE, B.A.

(Continued from page 272.)

It may be interesting to some, if, before I enter upon the details of the reformed Latin pronunciation, I give a few particulars concerning the circumstances of its introduction. The great authority upon the subject is the Rev. H. A. J. Munro, formerly Latin Professor at Cambridge. Mr. Munro remarks that "it is a delusion to suppose that there is a foreign as opposed to an English method. In England itself there is no one unvarying system." "To insure complete uniformity is an impossibility," but it seems to him "desirable to endeavour in theory after a worthy ideal, even if in practice we should many of us fall short of it." These and other reasons having been urged by a few enthusiastic spirits, the Oxford Philological Society proposed several alterations, and the head masters of some of the greatest schools in England met and discussed the matter. At their request, Professor Munro, in conjunction with the Latin Professor at Oxford, published in 1873, a "Syllabus of Latin Pronunciation," * in which the full extent of the proposed changes is enunciated. The question has since been discussed in various reviews and periodicals.† I find that at the present time some of the most important schools, as Eton, Harrow, and Rugby, have not yet adopted the reform. Among the schools that have adopted it are Marlborough, the City of London, Liverpool College, and most of the schools of the Girls' Public Day School Company.

The new pronunciation of Latin affects chiefly the vowel sounds. It is well known that in this respect the English language stands nearly alone; in most of the other European tongues—especially those which had their remote origin in the Latin—the greater part of the vowels is pronounced as in the following table:—

a as in făn, fāther.	*æ* = *a* in fate.
e as in fĕn, fête, (fate.)	*au* = *ow* in cow.
i as in fĭn, fatīgue.	*eu* = *you*.
o as in hŏp, hōpe.	*ei* as in height or veil.
u as in fŭll, rūde.	*œ* = *oi* in coin or like *æ*.

This is believed to represent (minute distinctions excepted) the vowel-sounds of the ancient Romans. Thus *ā* has the so-called broad (Scotch) sound; *ē* and *æ* have the sound which we generally give to *ā* in our own language; *ī* has the sound which we generally give to *ē*; and the two sounds of *u* are the same as those of *oo* in pool and book. But while this may be considered certain, the remaining diphthongs, especially *œ* and *ei*, are still doubtful. Little seems to be known of the sound of *y* in classical words; at present we must be content to pronounce it like *i*.

Among the consonants the changes are fewer; *c* is always hard like *k*, *g* is always hard as in *get* and *girth*, *j* always equals *y* in *yard*. The

* Deighton, Bell, and Co., Cambridge.
† See the "Academy," February—June, 1871. "Contemporary Review," April, 1871.

remaining consonants may be pronounced as at present; by some *v* is sounded like *v*, by others like *w*. It is not my business here to enter into the reasons which have led to the conclusion that these are the proper sounds of the letters, but it may be noticed that *j* and *i* were originally the same letter, and may be presumed to have been pronounced the same, while the evidence in favour of the hardness of *c* and *g* is overwhelming.

But here, to prevent misapprehension, it must be observed that no one proposes to introduce this change into English words, as is sometimes imagined. No one wishes us to pronounce circle, *kerkle*. In all truly naturalised words English habits will of course prevail; even the ill-used Cicero, when occurring with English words in an English sentence will be pronounced as at present; the reformation only applies to classical words used as such, and those formed in imitation of them. It will be certainly some time before it will be generally accepted, but its ultimate triumph seems at least probable. In the case of *g* there is not so much difficulty, as many English words contain a hard *g* before *e* or *i*, as *gear* and *gift;* but there seems to be a considerable reluctance to apply the same principle to *c*, though we have a precedent in the word sceptic, and also in Celt, Celtic, which are sometimes pronounced as if written with a *k*. If we adopt the "reformed" principles, we must sound all scientific names in this way, as, for instance, Cerastium and Geum; but the practice seems as yet so like an affectation that very few have adopted it. The novelty once overcome, it will be found that to an unprejudiced ear the new sounds are, to say the least, as euphonious as the old. The greatest obstacle lies in such words as Geranium and Cyclamen, which are used in English in an unchanged form. It seems strange to pronounce these in different ways at different times, as must be done in that case. Thus we may talk of scarlet Geranium as at present, but we should say *Geranium coccineum* with a hard *g* and *c*. Now to pronounce in this two-fold way words which are spelled alike is no more than is done every day by those persons who can speak more than one language. No one thinks of pronouncing the German *general* like the English *general*, or the French *voyage* like the English *voyage*, though they may have the same spelling and meaning.

There is one point in connection with the reformed scheme which finds admirers even amongst those who do not adopt the changes in the sound of the letters. I mean the pronunciation of the vowels strictly according to "quantity." As was explained above, (p. 269) every vowel-sound has two varieties, called respectively "long" and "short," but in the former conventional mode of pronouncing Latin this distinction was grossly neglected. Thus, *gĕnus* was generally pronounced with the *e* long, as if written *jeenus*; the word Ptĕris is often similarly mispronounced. To take another instance, it is usual to say "dulce dōmum," but the *o* is short, and the word should be pronounced thus—dŏm-um. To apply this principle, however, to scientific names requires an acquaintance with the quantity of the vowels in the different words, which can be obtained only by frequently consulting the dictionary, and is within the reach of few.

Finally, I must mention that in the reformed pronunciation all the consonants must be sounded no less than all the vowels. Thus in all such words as the following the initial letters must be heard:—Bdella, Cnestis, Ctenodus, Gnetum, Psammobia, and Pteris. Also the consonants must preserve their proper sounds under all circumstances, so that the *t*, *s*, and *c* in such words as Spartium, Blasia, and Vicia have the same sound as in other words where they are not followed by *i* and a vowel. The two latter practices might be adopted with advantage by even those who will consent to no other change, and are capable of a wider application. For instance, I do think that those who pronounce Calcium "Calshium," Strontia "Stronsha," etc., carry their love of the corrupt sounds of the English language to an unreasonable extent.

Having now touched on the chief topics connected with the pronunciation of Latin, we come to the far more difficult case of words derived from the modern languages. I have already laid down the only principle which seems to me to afford the slightest hope of general agreement upon this point. It is useless to attempt to tinker at the matter by dealing with special sounds, such as *ch*, as has been done by some; we must adopt one broad rule, which will comprehend all questions, or leave the present chaos undisturbed.

There are three cases of which examples may be found: (1) a word may be borrowed from a foreign language without undergoing any change—in this case we borrow the pronunciation also; (2) the word may be Latinised—in this case it will be treated exactly as a Latin word; (3) it may have a Latin ending tacked on to a "barbarian" stem—in this case we must take the pronunciation of the stem from one language, and of the termination from another. This would sometimes produce a curious result, were it not that the ending is generally simple, such as *-a*, *-ia*, or *-ii*. In some few cases the ignorance or inadvertence of authors has perpetrated worse combinations, *e.g.*, *Indigofera anil*, of which indigo is French, -fera Latin, and anil Portuguese.

A word by the way to prevent misconception: in speaking thus, I must not be understood to mean that ignorance of the niceties of Latin and Greek etymology is of itself blamable. It is so only when it pretends to be knowledge, and forms the incorrect assemblages of letters, which some naturalists (and also some barbers and tailors) elaborate. Looking at the jaw-breaking names often imposed upon innocent little creatures or plants, it might be thought that the number of euphonious combinations was nearly exhausted. So thought Charles Kingsley, when he said that men of science had been obliged to invent what we may suitably call these *cacophonic appellations*, "since they took to breaking up one species into ten." But it is not so; the number of smooth-sounding pleasant names is not only not exhausted, but practically inexhaustible. Even if Pleuroschismatypus were a correctly formed and very expressive term, we would readily exchange it for a simpler word. But I do not agree with those who are horrified at such names as Schweyckherta and Razoumowskia, they must stand on the same footing as Daltonia, Cruikshankii, and Fothergilli. We are not the only scientific people, and there

are probably some who find the three latter as hard to pronounce correctly as we do the two former names.

This brings us face to face with the difficulty of discovering the true sound of the letters in foreign words, but all that is wanting is a ready means of access to information on the subject, and a desire to learn on our part. The number of sounds really different from those which we ourselves use is fewer than is imagined, and still fewer are difficult for our tongues to pronounce, at least approximately. Absolute accuracy in all the nice shades of intonation which sometimes occur is out of the question, and besides quite unnecessary.*

In conclusion, then, I will sum up the system I propose for the pronunciation of such words as Lachenalia and Grabowskii. Let the vowel-termination have the sound already assigned to it in Latin words, (according to the reformed scheme,) and let the body of the word be pronounced as nearly as possible the same as in the language from which it is derived. This, however, is rather an ideal to be aimed at than a result to be attained, but it is not less worthy of pursuit than the far more unattainable ideal, in such cases, of a uniform Latin or a uniform English pronunciation.

SUBURBAN GARDENING.

BY EDWARD W. BADGER, F.R.H.S.

[*Continued from page 278.*]

SEASONABLE HINTS FOR AUTUMN.

The gardener is unceasingly called upon to exercise forethought. Scarcely an operation is performed by him the effect of which is immediate; in nearly all he does he has "to labour and to wait" for results. Whether he tills the ground, sows seeds, hybridises, grafts—whatever he does, he is dependent on the future for the fruition of his work. He cannot be successful in his pursuit unless he is always looking forward: hence moralists have seen that the work in which he is engaged is a good school for the training and development of his better nature. No part of his occupation is usually more pleasurable than the anticipatory work of autumn and winter. This is the time of year when he makes alterations in the arrangement of his beds, when he lays his plans for removing defects or supplying deficiencies with which previous seasons have made him acquainted. It is the time when he selects bulbs and early flowering plants for the adornment of his beds and borders, when the renovating spring time once more arrives and vegetation enters again on its annual period of active growth. It is also the time for the careful uplifting and re-planting of fruit and other deciduous trees and

* The nonsense which has appeared on this topic in several periodicals is amusing. Those who know little about it generally instance the German *ch* as a great stumbling-block; but, with strange fatality, they always quote as an example the word Fuchsia. Now it happens that in that word the *ch* has *exactly* the sound of *k*, and as a botanical name it should be pronounced *Fōōksia.*

shrubs, which are overcrowded or unhealthy, or which, growing too vigorously, require a gentle check to induce a sturdier and more compact style of growth. And now it is that he makes new plantations of nearly all sorts of trees, except evergreens.

I have already indicated the method of renovating and preparing the soil by trenching or double digging. This plan can generally only be employed in that part of the garden which is free from crops, and is scarcely applicable to the portion devoted to flowers, except in such beds as have been entirely filled with summer flowering plants of annual duration, or those which are too tender to winter out of doors, and which are usually known as "bedding out plants." Such beds when empty should be annually deeply dug and renovated by the addition of good turfy loam and partially decomposed manure. If they are to be used, as in suburban gardens they mostly will be, for "spring gardening," this work should be done at the earliest possible time after the summer occupants have been removed, so that the planting of bulbs and other flower roots may be done before severe winter weather sets in; thus doing what will be conducive to a fine display of flowers in the spring by affording ample time for the plants and bulbs to get well rooted. In beds not required for spring bedding the digging and renovation being done, the surface should be left as rough as possible, so that the largest amount of surface may be exposed to the sweetening and disintegrating influences of air and frost.

This, too, is the period when the mixed flower borders should be enriched and stored with material for the supply of food to the occupants in the coming year. Every herbaceous plant and patch of bulbs left in the ground should have its place marked by a tally, so that unnecessary disturbance or injury may be avoided. Where there is sufficient room between the plants and bulbs the vacant spaces should be gently forked with a small steel digging fork, (such as everyone should possess for use in the flower garden,) so as to loosen the soil as much as possible. Having gone over the bed or border in this way, some well-prepared compost should then be scattered all over it so as to finish it off neatly, though it will be better to avoid raking the surface. A handy workman will know how to complete the work in such a fashion as to leave it pleasant to look at, though sufficiently rough to get a good deal of benefit from the atmosphere and the varying temperature of the winter. Raking is a very unsatisfactory and deadening operation. It gives a smooth appearance to the soil and that is its only recommendation, but it produces a firm compact surface, very detrimental to the well-being of the plants, and I therefore advise the almost entire avoidance of the process.

The preparation of the compost to be used in the renovation of flower borders may fitly be described here, as I fear none but good gardeners know anything about it. A moment's consideration should satisfy any one that if plants are grown as they commonly are in the mixed flower border year after year in the same spot, and it is considered undesirable or inconvenient to move them very often, the soil in which they are planted must annually get more and more impoverished.

To compensate for this continual withdrawal from the stores of the soil an annual supply of such food as the plants require should be added at the surface, which is the only available spot. Every shower of rain will act on this surface dressing and carry some of its fertilising properties downwards, while the roots of the plants nearest the surface will be nourished directly and encouraged. This will give a general indication of the kind of compost most likely to answer the purpose. It should be rich in suitable materials, and in a condition easily soluble. It should not be littery in appearance, for it is to be applied to the ornamental part of the garden. This compost will vary according to circumstances. It should be prepared as opportunity offers and may consist of such thoroughly decomposed vegetable matter as can be most easily obtained, foremost among which may be named leaves of trees decayed into leaf mould, top-spits of old turf, especially of a loamy texture. Both these ingredients supply excellent food for nearly all sorts of plants, and when they have been turned over a few times, and are well pulverised, the food is in a condition of which the roots will rapidly take advantage. Well rotted dung, soot, and almost any other fertiliser, may go to enlarge and enrich the compost heap, the formation of which should be always going on in some reserve spot from whence it can be easily conveyed to any part of the garden where it may be wanted. This compost may be made still more valuable by the admixture of some of the good artificial manures which are now everywhere obtainable, and which supply easily soluble food for plants in general. By careful admixture the artificial manure will get evenly distributed; and, as it rarely happens that much of it is wanted at any one spot, the compost heap may well be made the means of causing its distribution in such doses as are compatible with its own richness and the wants of the plants it is applied to. This will be found a good plan for avoiding the injuries which sometimes occur through concentrated chemical fertilisers being applied in too large quantities, a cause of much mischief when they are applied by the inexperienced.

As has been hinted above, now is the time for planting many kinds of bulbs out of doors. Most of them will thrive in beds and borders prepared as above described. Crocuses should be got in the ground directly they are received from the seedsman, for they rapidly deteriorate, and are usually ready to commence forming roots as soon as they can be purchased. Snowdrops, Winter Aconites, and all other early blooming bulbs, should also be planted early. They should be placed not less than two inches below the surface, and where the soil is light in texture they may be planted deeper with advantage, especially Crocuses, if they are intended to occupy the same spot for more than one year, their habit being to grow nearer the surface every year. Tulips and Hyacinths may be planted somewhat later, and batches may be reserved to be planted later still to provide a succession of bloom. Both sorts of bulbs are plentiful and cheap. Where quantities are grown, it is as well to grow masses of the same kind together, so as to ensure uniformity in height,

style of growth, &c., and very pretty effects may be produced by such an arrangement of the groups that the colours of the flowers may contrast and harmonise well. But, in the bulk of small gardens, for the owners of which these hints are chiefly intended, mixed beds will be found the most useful. For instance, an interesting display may be made in the same bed by planting together mixed Hyacinths and single and double Tulips, using both early and late blooming kinds to prolong the show of flowers. These bulbs should occupy the central portions of the bed. Then around the larger bulbs a border of lines or patches of mixed Crocuses will find a proper place, and plants of Daisies, Forget-me-Nots, *(Myosotis dissitiflora,)* and dwarf-growing Wall Flowers may be planted thinly all over the bed, giving it a furnished appearance even in winter, and adding to its charms in spring.

Among the hardy bulbs which should be grown, Scillas will generally be included. There are many kinds, but the two I shall recommend are *Scilla amœna* and *S. sibirica;* they should be planted in clumps of not less than six bulbs each, a couple of inches apart all ways. Then the Narcissus family will afford early and late flowering kinds, most of which are very beautiful. These may remain in the same spot for several years with advantage. The kinds now to be purchased cheaply are so numerous I cannot attempt their enumeration; any seedsman will supply a collection on receiving an order, and as none are without beauty I do not think any one will be disappointed by leaving the selection to the tradesman from whom he buys his bulbs. Of course no one will omit to secure a goodly number of the single and double Poet's Narcissus; and none of the family will yield more pleasure or lighten the garden with brighter beauty than clumps of the bunch-flowered Daffodil *(Polyanthus Narcissus.)* A well-selected collection will furnish a succession of flowers from February till June.

Dog's-tooth Violets are charming in leaf and flower; the Wood-hyacinths, of which we have now many lovely kinds, are easy to grow and beautiful; Triteleias, too, deserve a place everywhere, and their beauty is enhanced when *Anemone apennina* is grown in association with them. And having mentioned Anemones, I cannot resist advising the planting in every garden of *Anemone fulgens*. This is an early blooming kind, producing lovely flowers of the brightest scarlet. Half-a-dozen roots should be planted together, so as to ensure a decided effect. Other sorts of Anemones should also be planted for early blooming, the middle of October being generally regarded as the best time. For the later period of flowering, the roots should be planted at the end of January on a dry day. I must not pass from bulbs without a word about Irises. Many of them are as varied and beautiful as Orchids. The bulbous kinds best known are those called English Irises and Spanish Irises, the latter blooming earliest, and having the smallest flowers, which are, however, most lovely. Both sorts should be planted forthwith. *Iris reticulata* is a gem which blooms from February to April, opening its sweet-smelling flowers in a temperature too low for the development of Narcissus blooms. Then there are the Flag Irises in numberless variety,

the most exquisite of all being the Japanese sort, *Iris Kæmpferi*, which thrives and blooms best if planted in sandy peat. It is necessary to bear this in mind, as this Iris does not bloom freely in all soils.

The plants on which, next to bulbs, we mainly rely for the decoration of the garden in the spring must of course be planted at once. I have already alluded to them incidentally, and I will merely, as a reminder, mention such as may be relied on to assist in producing an effect which I am glad to say is yearly becoming more common—a garden gay with bright flowers during some of the early months:—Alyssum saxatile, Arabis albida, the variegated form of same, Aubrietia Græca and grandiflora, Alpine Auriculas, Cheiranthus alpinus, Daisies, (white, pink, red, and crimson,) Dielytra, Forget-me-not, Hepaticas, (particularly H. angulosa,) perennial Candytuft, Pansies, Polyanthuses, Primroses, (double and single,) Silene pendula, Veronica incana, Violets, Violas, and Wallflowers. To these many others might easily be added, but from this list enough may be selected for most small gardens. I will not pass from this subject without recommending any who may wish to know more about spring gardening to buy a little book, (published at the "Journal of Horticulture" Office, in London,) by Mr. John Fleming, the famous gardener at Cliveden, the title of which is "Spring and Winter Flower Gardening." Its price is half-a-crown.

Roses should be planted now in preference to spring; first, because deciduous trees are best transplanted while in a state of rest, and especially just after the leaves have fallen; and, secondly, because in purchasing plants from the nurserymen the best plants can be obtained early in the season. Roses should be planted in rich, deep soil, heavily manured, inclining to stiffness naturally, or made so by the addition of marl. Standard roses are often preferred, but they are shorter lived than dwarfs budded low on Manetti or seedling briar stocks, or grown on their own roots. Roses on the Manetti will thrive in lighter soils than those on the briar; but they must be so planted that the point of junction between stock and scion is a couple of inches below the surface of the soil. It is therefore necessary to know whether the plants are on the Manetti or not, as failure to attend to the foregoing direction will be injurious to the plants.

All kinds of hardy herbaceous plants may now be planted. Of these I will only mention two kinds, which are not so well known as they deserve to be. *Pyrethrums* are some of the flowers in which the florist has worked the most wonderful improvement during recent years. They are cheap and perfectly hardy, and the best forms are very double. Their colours are most varied, for we have whites, lilacs, pinks, reds, crimsons, and purples of various shades. The flowers are early, plentiful, and most enduring. For a lasting, useful autumn flower nothing is better than *Anemone Honorine Jobert*. It is tall in growth, and yields a profusion of large white flowers, most valuable for cutting. It is very hardy and easy of cultivation. This and the *Pyrethrums* should be planted at once in good soil, and plenty of room allowed for the proper development of the plants, for the finer they are the better they will bloom.

[TO BE CONTINUED.]

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF OCTOBER, 1879.

BY W. JEROME HARRISON, F.G.S.

STATION.	OBSERVER.	RAINFALL. Total for M. In.	Greatest fall in 24 hours. In.	Date.	No. of rainy d.	TEMPERATURE. Greatest ht. Deg	Date.	Great'st cold. Deg	Date.
GLOUCESTERSHIRE.									
Cheltenham	R. Tyrer, Esq.	1·12	·29	24	13	65·0	4	24·5	16
Stroud	S. J. Coley, Esq	1·24	·46	1	9	67·0	8	32·0	17
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	1·42	·36	24	12	61·0	1	27·0	16
Woolstaston	Rev. E. D. Carr	1·59	·48	24	17	63·0	10,11,12,	32·0	16
Leaton Vicarage	Rev. E. V. Pigott	1·52	·61	24	13	62·1	1 & 4 (13	25·0	16
More Rectory, Bishop's Castle	Rev. A. Male	1·40	·25	24	17	64·0	6	26·0	16
Larden Hall	Miss F. R. Boughton	1·47	·20	24	13	63·0	4	33·0	16
Bishop's Castle	E. Griffiths, Esq.	1·19	·23	19	12	62·0	8	26·0	16
Cardington	Rev. Wm. Elliott	·81	·27	24	7				
Stokesay	Rev. J. D. La Touche	1·20	·38	24	13	62·9	6	26·6	16
HEREFORDSHIRE.									
Stoke Bliss	Rev. G. E. Alexander	·97	·19	24	13	62·0	4	30·0	15
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq	1·07	·21	24	12	65·0	4	27·8	16
West Malvern	A. H. Hartland, Esq.	2·17	·22	21	17	64·5	4	29·5	15
Pedmore	E. B. Marten, Esq.	1·37	·31	24	15	64·[illegible]	3	30·0	15
Longlands, Stourbridge	J. Jeffries Esq.	1·2[illegible]	·30	24	12	64·0	1, 4, 7	26·0	15
Dennis, Stourbridge	Mr. C. Webb	1·21	·34	24	15	64·0	5	26·0	15
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	1·06	·25	2 & 24	16				
Dudley	Mr. J. Fisher	1·14	·35	24	12				
Sedgley	Mr. C. Beale	·98	·34	24	16	60·0	5 & 7	33·0	15 & 16
Kinver	Rev. W. H. Bolton	1·16	·26	24	15	63·0	4	27·0	15
Walsall	Mr. N. E. Best	·99	·29	24	13	60·0	4	31·0	15
Grammar School, Burton	C. U. Tripp, Esq.	·94	·25	2	16	67·0	5	28·0	16
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	1·37	·40	24	19	63·0	1	28·0	16
Wrottesley	E. Simpson, Esq.	·99	·29	24	12	61·7	6	30·2	16
Heath House, Cheadle	J. C. Philips, Esq.	1·27	·33	2	13	62·0	5	31·0	16
Alstonfield Vicarage	Rev. W. H. Purchas	2·08	·53	19	10	61·0	5	27·0	26
Farley, near Cheadle	C. L. Wragge, Esq.	1·89	·39	1	17	61·5	5	28·7	16
Oakmoor	E. Kettle, Esq.	2·61	·39			64·8	5	27·2	16
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	1·04	·34	2	12	62·0	1 & 4	33·0	15
Coventry	J. Gulson, Esq.	·85	·17	2	16	64·0	5	32·0	16
Bickenhill Vicarage	J. Ward, Esq.	·87	·35	21	5	50·0		32·0	
St. Mary's College	Rev. S. J. Whitty	·86	·27	24	11	64·9	5	31·1	16
Henley-in-Arden	T. H. G. Newton, Esq.	1·18	·30	2	12	65·5	4	31·0	16
Rugby School	Rev. T. N. Hutchinson	1·17	·28	1	13	66·2	4	31·0	16
DERBYSHIRE.									
Stoney Middleton	Rev. U. Smith	1·19	·26	14	9	61·0	4 & 5	29·0	15 & 25
Fernslope, Belper	J. G. Jackson, Esq.	1·11	·30	2	13	62·0	1 & 5	32·0	26
Linacre Reservoir	C. E. Jones, Esq.	·83	·20	14	10				
Spondon	J. T. Barber, Esq.	1·16	·35	2	13	60·0		29·0	14
Duffield	W. Bland, Esq.	1·35	·31	2	14				
NOTTINGHAMSHIRE.									
Hesley Hall	B. J. Whitaker, Esq.	·96	·24	14	13	66·0	7	32·0	29
Tuxford	J. N. Dufty, Esq.	·7[illegible]				59·0	2 & 4	30·0	26
Hodsock Priory, Worksop	H. Mellish, Esq.	·84	·21	14	13	65·5	1	28·2	26
Park Hill, Nottingham	H. F. Johnson, Esq.	1·14	·32	2	11	62·8	5	30·0	15
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	·65	·12	1 & 14	13	67·1	6	30·0	26
Ashby Magna	Rev. E. Willes	·77	·22	24	10	66·0	4	26·0	16
Market Harborough	S. W. Cox, Esq.	·59	·14	2	11	61·0	1 & 5	26·0	26
Kibworth	T. Macaulay, Esq.	·70	·15	23	9			27·0	26
Town Museum, Leicester	W. J. Harrison, Esq.	·91	·30	2	15	64·0	6	33·0	16
Belmont House, Leicester	H. Billson, Esq.	·90	·30	2	14	65·5	6	34·0	16
Syston	J. Hames, jun., Esq.	·75	·17	1 & 2	13	64·0	7	31·0	16
Waltham-le-Wold	E. Ball, Esq.	·90	·20	1	11	58·0	5	28·0	15
Little Dalby Hall	G. Jones, Esq.	·79	·23	2	12	65·0	4	26·0	16
Foxton Locks	Union Canal Company	·52	·20	2	6				
Coston Rectory, Melton	Rev. A. M. Rendell	·75	·20	2	1[illegible]	61·8	5 & 19	28·0	28
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	·67	·20	19	8				
Castle Ashby	R. G. Scriven, Esq.	·62	·16	24	9	64·0	4	33·[illegible]	15
Kettering	J. Wallis, Esq.	·63	·21	24	12	62·0	2, 5, 6	33·0	16
Althorpe	G. S. Groom, Esq.	·59	·20	24	10	62·0	5	30·[illegible]	15 & 25
RUTLAND.									
West Deyne, Uppingham	Rev. G. H. Mullins	·56	·12	2	15	63·6	6	31·[illegible]	16
Northfields, Stamford	W. Hayes, Esq.	·56	·11	19	10	60·1	1	29·0	26
Ratcliffe Observatory	E. T. Stone, Esq.	·73	·18	21	10	65·1	4	[illegible]	15
Ventnor Hospital	W. T. Ryder, Esq.	1·13	·30	24	5	6[illegible]·0	5	[illegible]	16
Altarnun Vicarage	Rev. J. Power, M.A.	4·04	1·03	20	21	67·0	8	27·[illegible]	16

At last we can record a cessation of the continuous wet which marred the summer of 1879. Although little rain fell, yet the effect of previous downpours and the thorough saturation of the ground was visible in the damp condition of the atmosphere, and the consequent heavy fogs which prevailed, more especially during the first half of the month; for the same reason there was little sunshine. Light easterly winds prevailed, with a high barometer. The harvest was in the main secured by the middle of the month, but was very deficient in quantity and quality.

NATURAL HISTORY NOTES BY OBSERVERS.—*Spondon.*—Of moths, *Mamestra brassicæ* has been abundant, and of course destructive. Very few *Plusia gammi* have been seen. *Burton-upon-Trent.*—Wasps very late and scarce; Ladybirds plentiful. *Nottingham.*—Scarcely any wall fruit has had the right flavour, and all had the appearance of wanting more sun. *Coventry.*—A wonderful crop of plums and damsons, but they have not for the most part ripened well, or come to much perfection. The dull and sunless character of the season has deprived the fruit of its usual flavour. *Cheltenham.*—A sharp frost on the 16th, causing the leaves to fall rapidly from some trees, and giving others their beautiful autumnal tints. By the end of the month the elm trees and oaks alone kept their foliage, that of others—as horse chestnuts and walnuts—being all off, or very much thinned. *Wrottesley.*—Fieldfares first seen on the 5th. *More Rectory.*—A few Redwings seen on 29th. *Stroud.*—Swallows finally left on 9th. *Hodsock Priory.*—First gray Crow, (*Corvus cornix,*) seen on 24th. *Shifnal.*—The harvest at length completed by the middle of the month; but all grain, although not greatly damaged, most deficient in yield. Damsons, an immense crop, 2d. per quart. Hazelnuts also abundant. Apples almost a failure, but Pears abundant, although many sorts cracked all over. Only one Peacock Butterfly seen as yet; not a single Red Admiral. A Humming-bird Sphinx caught on 27th. *Farley, near Cheadle.*—*Turdus merula* seen only occasionally; *T. musicus* become almost a *rara avis* in this neighbourhood. October 5th, noticed a few Blackberries ripe; Hazelnuts fairly plentiful, and ripening to full kernel; same evening observed *Spiræa ulmaria,* (Meadow Sweet,) still in flower. October 9th, Elm and Mountain Ash becoming rapidly bare. October 13th, top of Sycamore bare. October 16th, gathered some fine Wild Strawberries, quite ripe, and very fully matured. October 18th, samples of Elm, Sycamore, and Lime generally bare. October 20th, Harebell still in flower. October 21st, some Horse Chestnuts quite bare. October 22nd, "Hips and Haws" plentiful and fully ripe. October 25th, top of Beech bare; Acacia bare. October 26th, Harebell still in flower; same day noticed quantities of unripe Blackberries—a very little ripe fruit, blighted, (evidently by the recent frost.) October 29th, Birch, Wild Cherry, Lime, and Beech generally bare; Elm, Sycamore, and Horse Chestnut "universally" bare; Yellow Gorse in flower. October 30th, saw a *Digitalis purpurea,* (Foxglove,) well in flower. *Geranium pratense* (?) generally in flower at end of month.

Correspondence.

LEPTODORA HYALINA.— "Enquirer" is quite wrong in saying (p. 283) that in the order Cladocera the limbs are always enclosed within the carapace. If he will refer to Baird's Entomostraca, (p. 62,) he will find that the whole *body* except the head is so enclosed; (but not the feet.) In the first family Daphniadæ, there are five or six pairs of feet, all enclosed within the valves of the carapaces, (p. 62;) but in the second family Polyphemidæ, there are four pairs of legs, not contained within the shell; (p. 111.) Therefore the Leptodora is *not* excluded from the Cladocera on account of its feet being without the carapace.—W. S Beaumont, Bowdon, Cheshire.

Pronunciation of Scientific Names.—In the last number of the "Midland Naturalist" I notice a most useful article by Mr. W. B. Grove on the above subject; and as I have taken some pains in my work on British Conchology to accentuate the scientific names, I venture to make one or two suggestions to the author of the article. The first is with respect to the name of the oyster, *ostrea*, *ὄστρεον;* the *e* does not represent a Greek diphthong. Mr. Grove has twice placed the accent on the middle syllable; but it ought to be on the first syllable, the middle being unquestionably short. This quantity is given by all Latin poets, Lucilius, Horace, Juvenal, Ovid. A scholar might well stare if he heard the name *O'strea edu'lis* mispronounced by making the middle syllable in the first word long, and in the second word short. *Polygonum*, being the name of a plant, is derived from *γόνυ*, a knee, and not from *γωνία*, an angle; so that the penultimate syllable is properly short. If it had been derived from *γωνία*, the penultimate syllable would of course be long. *Polygo'num* (a polygon,) as well as *trigo'nus*, *tetrago'nus*, *pentago'nus*, and *heptago'nus* are cases in point. *Hypericum (hypericon*, a plant = *ὑπερικόν*) clearly has both the middle syllables short; and therefore custom has adopted the right pronunciation. I may also mention that by the well-known rules of the British Association for zoological nomenclature the names of families should end in *idæ*. It would consequently be irregular to say *Craniadæ*. See page 271, line 6 from the bottom.—J. Gwyn Jeffreys, Ware Priory.

The Defoliation of Trees and Ripening of Fruits.—A yearly record of observations on the defoliation of our common trees and shrubs, the ripening of their fruits, with notes on the quantity and quality, can scarcely fail to be of interest and use to many lovers of nature. The following notes on the subject may not be unacceptable to some other readers of the "Midland Naturalist:"—Dewberries, or the fruit of *Rubus cæsius*, were this year ripe by August 26th; very few and small this year. Summering Apples were ripe about September 4th. Limes began to turn yellow by September 7th. A very poor show of Blackberries this season; *Rubus rhamnifolius* and *R. corylifolius* ripe about the 8th, the more common kind, *R. discolor* by 20th. Drupes more harsh and watery than usual. Plums ripened about the second week in the month; a very fair crop. Fruit of *Lonicera Xylosteum* ripe about 17th. Hazel Nuts and Filberts were very plentiful, many of them were small and unsound; ripened about 24th. Wild Plums ripe by 24th. Sycamore, Walnut, and Lime trees cast their leaves about 25th. Fruits of *Viburnum Opulus*, Lonicera, Solanum, Tamus, Bryonia, and Snowberries, *(Symphoria racemosa,)* ripened about the end of the month. Apples and Pears, both wild and cultivated, are rather scarce this year, although there were a few trees scattered about that bore a fair crop. Crabs and Poplar trees cast their leaves about October 8th. Hips and Haws ripe by 10th; very few in some places, more in others. Elderberries ripened about 10th; a very good crop this year. Damsons ripe about 14th. Sloes began to ripen by 15th. Many Ash trees are loaded with keys, (samaræ,) which ripened about 18th. The leaves fell from the fertile trees before the barren ones. Chestnuts began to fall about 13th; very few, and small. Fruits of *Viburnum Lantana*, *Cornus sanguinea*, and *Ligustrum vulgare* ripened about 20th. Beech, Birch, Maple, Alder, Chestnut, Elm, and other trees shed their leaves by 24th. Berries of the Buckthorn and Spindle trees ripe by the first week in November. Leaves of the Oaks, Aspens, Buckthorn, Hawthorn, Pear, Hazel, and many other trees falling in the second week in November. Many of the trees began to show their peculiar autumnal hues unusually early this year owing to the long continued wet weather.—R. R., Castle Ashby, November 13th, 1879.

Ornithological Notes from Oxfordshire.—A fine specimen of Richardson's Skua was killed at Milcombe, in this county, on October 15th. It is, I believe, the first occurrence of the bird in this district. A Common Skua was obtained at Eydon, Northamptonshire, on the 18th of that month, and on the 7th instant a Cormorant was shot on Clattercut Reservoir. The occurrence of these sea birds so far inland, considering the fine weather we have been lately enjoying, is very unusual. Two Turtle Doves were seen on September 29th—a very late stay. I did not notice Fieldfares, nor could I hear of any being seen, till the 22nd ult., when I observed a flock of about a hundred flying over. Several Spotted Crakes were brought to Mr. Wyatt, the taxidermist at Banbury, during last month, all killed in the neighbourhood; also one Hawfinch. The former bird is believed to breed on the Cherwell. Mr. Wyatt informs me that he has had young birds once or twice. A Red-legged Partridge had its nest this season on the thatch at the corner of a corn stack about five feet from the ground—an uncommon situation, I should imagine. The bird, however, seldom breeds here; it is the only instance I know of its doing so in this parish; a few years ago it was unknown; now it is gradually increasing. Song Thrushes and Blackbirds are here now in large numbers, feeding on the berries of the yew; they are doubtless migrants, as during the summer they were far from plentiful. These berries are very attractive, and even draw a few Missel Thrushes into the gardens, shy as they usually are at this time of year. Greenfinches also come in small flocks. Snipe have been plentiful. I put one up from amongst some cut beans—an unusual place. A few Jack Snipe have been shot; the first was on September 24th, rather an early arrival. They do not come to us, as a rule, before the middle of October. I have recently obtained a young Hobby; it was taken about four miles from here, and reared by hand; I find it far more docile than the tame Kestrels I have come across—in fact, I have generally found the latter bird rather vicious.—O. V. Aplin, Bodicote, Oxon, November, 1879.

Ornithological Notes.—I have not at present seen any Fieldfares or Redwings, which indicates an absence of the very cold weather in the north, which drives them southward. I have noticed some large flocks of Peewits, which are very interesting to watch; I suppose they have rather enjoyed the wet season, as they usually congregate in the autumn over the low and marshy lands. I have sometimes observed a large battalion of them wheeling about for some time and then dividing into companies, flying off to their feeding ground, where they alight and seek their food, which consists of slugs, worms, and insects. For two or three nights I had the pleasure of hearing the distinct note of a Brown Owl in the Combe Woods. It is several years since I heard one. I suppose the poor bird met with the usual fate, as after a few nights I heard no more of him. The equinoctial storms have driven some of the sea birds as far inland as our midland district, and several species of the gull tribe have been seen in this neighbourhood. A "Pomerine Skua," not a common bird even on our coasts, was lately caught alive on Wyken Slough. The bird was nearly starved and too weak to make its escape. The Skua breeds in Iceland and the north of Europe, but visits our shores in autum and winter, and is occasionally driven inland, as this was. It is a very strong and powerful bird, of rapid flight, and rapacious habits. The Skuas are said even to drive away the eagles, and are encouraged and preserved by the shepherds in the countries where they build as a protection to their flocks. It appears to be a young bird, the legs and upper part of the beak being of a bluish colour. It would measure about three feet across the extended wings. Mr. Elkington, of this town, has also a nice specimen of the "Spotted Crake," which was lately shot at Whitley.—John Gulson, Coventry, November 5th.

SWALLOWS.—At this place a nest of young Swallows "flew" on the last day of September this year. The eggs were hatched about the middle of the month.—W. S. GRESLEY, Overseal, Ashby-de-la-Zouch.

Gleanings.

BOTANICAL CATALOGUE.—Mr. Wheldon, the well-known bookseller of 58, Great Queen Street, Lincoln's Inn Fields, has lately issued an extensive catalogue of botanical works, second-hand and otherwise, which may be of service to many of our readers.

METEOROLOGICAL BOOKS.—Those who are interested in the science of Meteorology should write to the editor of the "Meteorological Magazine," Mr. G. J. Symons, 62, Camden Square, London, for his "Catalogue of Duplicate Old Books, by Airy, Buys Ballot, Ellery, Forbes, Glaisher, De la Rue, Piazzi Smyth, &c."

LEPTODORA HYALINA.—Some doubt appears to exist as to the proper mode of pronouncing the generic name of this entomostracan. Its etymology, however, plainly points out the correct pronunciation. It is derived from λεπτος thin, and δορα, a hide or skin, in allusion to the thinness or transparency of the body. The "o" in *dora* is short, so in the word Leptodora, the penultimate being short, the accent must be placed on the anti-penultimate thus:—Lepto′dŏra, not Leptŏdo′ra.

THE MINUTEST FORMS OF LIFE.—The Rev. W. H. Dallinger, F.R.M.S., recently delivered a lecture at Birmingham on the investigations of the minutest forms of life, in which he and his fellow-worker, Dr. Drysdale, have been so long and successfully engaged. In a most lucid and interesting manner he gave some of the results of their laborious researches, and skilfully managed to convey a clear notion of such an abstruse subject as the life history of monads and other minute organisms to a mixed audience, most of whom were probably totally unfamiliar with the subject. It was one of the best lectures we ever heard.

NECROSCILLA WILSONI.—At the May meeting of the Geological Society a paper was read by H. Woodward, Esq., LL.D., F.R.S., F.G.S., on *Necroscilla Wilsoni* a supposed Stomatopod Crustacean from the Middle Coal Measures, Cossall, near Ilkeston, Derbyshire. The specimen described was found by Mr. E. Wilson, of Nottingham, in a nodule of clay ironstone. It consists of the four posterior abdominal somites and the telson. The author discussed its zoological characters, which led him to regard it as approaching the Stomatopoda rather than the Isopoda. He thought it probable that Dr. Dawson's Diplostylus is allied to this newly-discovered form, for which he proposed the name of *Necroscilla Wilsoni*.

Reports of Societies.

BIRMINGHAM SCHOOL NATURAL HISTORY SOCIETY.—GENERAL MEETING.—September 26th. Paper on "Hydra," by Bernard Badger, and living specimens of *H. fusca*, *viridis*, and *vulgaris*.—GENERAL MEETING.—October 10th. Paper on "Compositæ," by Charles. *Cristatella mucedo* was exhibited by Badger.—GENERAL MEETING.—October 24th. Paper on "Remarkable Beetles," by J. Dammann; specimen of Sexton Beetle exhibited.—GENERAL MEETING.—November 7th. Paper on "Vegetable Cells," by H. Devis.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—MICROSCOPICAL GENERAL MEETING.—October 21st.—Mr. A. W. Wills read a very interesting paper on the structure and life-history of *Volvox globator*, illustrated by beautifully executed coloured diagrams and specimens in the microscope. He described at length the gonidia, which stud the surface of the globe, the network which connects them together superficially, and the primordial utricle beneath, in which they are imbedded, each gonidium being provided with two cilia projecting through orifices in the latter. He next described the asexual reproduction of *Volvox*, when a single gonidium here and there enlarges and sub-divides continuously until it becomes a spherical mass of green cells, closely appressed to one another so as to be roughly hexagonal, but subsequently increasing the space between them until the whole forms a perfect *Volvox* sphere like the original, and a little before reaching maturity bursts from the parent sphere through an orifice, rather smaller than itself, formed at the north pole of its axis of revolution. This process may be repeated through many generations, but at length a true sexual method of reproduction occurs, a true spore being formed by the union of two gonidia, supposed to have the properties of male and female elements. This spore remains dormant through the winter, and develops into a fresh *Volvox* by sub-division in the following spring, but Mr. Wills had never seen this take place. He said that some observers were of opinion that the male and female gonidia occurred in the same sphere, others in different ones. Probably both may happen. He had not been able in every case to verify the results of Williamson, Busk, and others; and in some few respects his observations differed from theirs. GEOLOGICAL SECTION.—October 28th.—Mr. Montagu Browne exhibited a specimen of the Blue Shark, *(Squalus glaucus,)* captured near Great Yarmouth, 13ft. in length, and weighing nearly half a ton. Mr. R. H. Burman exhibited a pebble of quartz from the drift near Walsall, containing what appeared to be a flake of gold. Mr. J. W. Cotton sent some specimens of Manganese and the rocks in which the veins occur at Barmouth. Mr. T. H. Waller exhibited sections of opalised wood, from California. Mr. Watson exhibited dog-tooth and fluor spar, toadstone and bitumen, from Castleton, Derbyshire. Mr. J. Morley presented to the society, on behalf of Mr. Tresider, of Falmouth, some rock specimens from West Cornwall. Mr. R. H. Burman read an interesting paper on the geology of Falmouth and neighbourhood, illustrated by specimens of the slates, sandstones, granite, and serpentine of the district. GENERAL MEETING.—November 4th. Mr. Thos. Bolton exhibited *Ophrydium versatile*, from Walsall, and a number of Rotifers. Mr. J. F. Goode exhibited a female *Diaptomus castor*, with spermatic tube attached to the operculum vulvæ. Mr. W. H. Jones exhibited living specimens of *Ophiocoma neglecta*, which had been kept in artificial sea-water for three months. Mr. W. G. Blatch read an interesting paper on entomological work in winter, showing the fallacy of the popular notion that insects are only to be found in summer, by describing the results of an afternoon's hunt in Sutton Park, and the successful results of the various modes adopted for procuring insects. At the conclusion of the paper, a discussion took place, in which Fraülein Lauprecht and Messrs. J. Morley, J. E. Bagnall, J. F. Goode, H. E. Forrest, and others took part. The discussion drifted away from the subject of the paper to that of "garden pests," and elicited from Mr. Blatch a promise to give the society, at some future time, a paper on two of the commonest of these, the larvæ of the Sawfly and the Magpie Moth. BIOLOGICAL SECTION.—November 11th.—Mr. J. E. Bagnall exhibited *Leucobryum glaucum*, in fruit, from Massachusetts; and the Protonema of an Hepatica, probably *Pellia epiphylla*, shewing peculiar stalked bodies arising from it, described by Luerssen as "brood buds" (Brutknospe.) Mr. J. F. Goode exhibited ova of an Entozoon from the intestinal canal of a sprat. Mr. H. W. Jones exhibited *Callionymus lyra*, the yellow sculpin, found amongst a lot of sprats in the fish market: and living specimens of a species of prawn, *Palæmon varians*. Mr. A. W. Wills exhibited *Cylindrospermum humicola*, a minute Alga belonging to the order *Oscillatoriaceæ*; and zygospores of *Spirogyra*, in various stages of germination. M. G. S. Tye read his report on the Mollusca taken by members of the Society during the recent excursion to Falmouth, from which it appears that the total number of species taken was sixty-three, but that from the absence from among the party of any experienced conchologist many species were unrepresented which undoubtedly would have rewarded a more systematic examination of the ground.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY. —October 29th, Mr. E. Evans read a paper on "Scientific Culture." November 12th, Mr. Wright Wilson exhibited and described a "New Acoustic Apparatus."

BURTON-ON-TRENT NATURAL HISTORY AND ARCHÆOLOGICAL SOCIETY.—November 11th.—The President, (Mr. H. G. Tomlinson,) read his second paper on "Birds and their Habits," the substance of which will be given in a future number. A cordial vote of thanks was given to the President.

CHELTENHAM NATURAL SCIENCE SOCIETY.—November 5th.—An extra meeting was held at the Ladies' College, when J. Fisher, Esq., of Stroud, gave an admirable paper on "The Spectroscope and its application to Solar and Stellar Physics." The paper was illustrated by a very powerful instrument, and electric apparatus by Browning. About 120 persons were present.

EVESHAM FIELD NATURALISTS' CLUB.—The annual meeting of this club was held on November 11th, Mr. T. J. Slatter in the chair. Mr. Slatter was elected president, Mr. J. S. Slater treasurer, and Mr. J. H. Pumphrey secretary *pro. tem.*, Mrs. Martin, and Messrs. T. E. Doeg, A. H. Martin, F. Wright, and J. S. Slater were elected the committee. The annual report stated: "Your committee in presenting their seventh annual report, regret that the club has not recovered from the depression which they deplored last year, and can only hope that during the next twelve months it may take a fresh start, and flourish more vigorously than before. The numbers of the club have neither increased nor diminished, being twenty-eight. Owing to the bad weather the usual excursions during the summer have had to be abandoned. The evening meetings were held monthly during the winter, the following papers being read: 'Some Common Minerals,' by the Rev. M. Wood; 'The Glacial Deposits of the Vale of Evesham,' by the Rev. A. H. W. Ingram; 'The Reproduction of Ferns,' by Mr. J. S. Slater; and 'Some of the Birds of our Neighbourhood,' by Mr. T. E. Doeg. The financial position of the club is more satisfactory than it ever has been, the treasurer having a balance in hand of £4 16s. 1d."

NOTTINGHAM NATURALISTS' SOCIETY.—November 5th. Mr. J. Shipman read a most interesting paper, entitled "Notes on the Alluvial Deposits of the Trent Valley in the Neighbourhood of Nottingham." As the paper will be printed in a future number, it is needless to give a *resumé* of it.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.— October 2nd, Soireé. October 3rd, Gilchrist Lecture, R. A. Proctor, Esq., F.R.A.S., subject "The Birth of the Solar System," illustrated by the oxyhydrogen light. October 9th, inaugural address by the President, Rev. R. A. Armstrong, on "What is Science." Ocober 24th, Gilchrist Lecture, Dr. W. B. Carpenter, C.B., F.R.S., subject, "A Piece of Limestone," illustrated by the oxyhydrogen lantern. October 30th. Gilchrist Lecture, Prof. P. M. Duncan, F. R.S., subject "Energies within the Earth: Mountain Making," illustrated by the oxyhydrogen lantern. November 20th, J. H. Brown Esq., subject, "Festus."

STROUD NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.— November 11th.—Mr. E. Evans read a most interesting and instructive paper on "The Birds of Gloucestershire," which we hope may be published at length in a future number. The paper was illustrated by a fine collection of birds, so arranged as to make inspection easy.

EXCHANGE.

Land and Freshwater Shells in exchange for Books on Conchology, Botany, and Geology, or Shells.—C. T. Musson, 68, Goldsmith Street, Nottingham.

A good series of *Terebratula punctata* and *Rhynchonella tetrahedra* (two dozen of each) from the Middle Lias of Leicestershire, for any other Fossils.—F. G. S., 3, Melbourne Road, Leicester.